J4. Effect of Light Scattering upon the Apparent Refractive Index of Dispersed Polymers.* M. NAKAGAKI AND W. HELLER, *Wayne University.*—Precise determinations of particle size and molecular weight of polymer spheres by means of the Mie theory requires that the refractive index of the light scattering material is accurately known. An experimental determination of the refractive index, using any of the existing mixture rules proved inadequate unless the results obtained are extrapolated to zero-particle size.[1] At all finite particle sizes, the refractive index obtained is only an apparent quantity due to complications arising from both forward and backward scattering. Following recent work by Zimm and Dandliker,[2] concerned with the effect of forward scattering upon the Rayleigh ratio, the theoretical variation of the apparent refractive index was established as a function of the theoretical forward scattering as derived from the Mie theory. The computations were carried out for a series of relative refractive indices up to 1.30 and for α values up to 8.0, covering herewith the entire submicroscopic range. The theoretical data obtained fit very satisfactorily the experimental data referred to above.

* This work was supported by the Office of Naval Research.

[1] W. Heller and T. L. Pugh, paper presented before the Division of Polymer Chemistry at the 128th meeting of the American Chemical Society, Minneapolis, Minnesota, September, 1955.

[2] B. H. Zimm and W. B. Dandliker, J. Phys. Chem. 58, 644 (1954).

J5. Influence of Diluent and of Copolymer Composition on the Glass Temperature of a Polymer System. T. G. FOX, *Rohm & Haas Company.*—A relationship for the dependence of the glass temperature on composition for a copolymer or a plasticized polymer may be derived from simple assumptions. In the limiting form it becomes

$$\frac{1}{T_g}=\frac{w_1}{T_g(1)}+\frac{w_2}{T_g(2)}.$$

For a plasticized polymer $T_g(1)$ and $T_g(2)$ represent the glass temperatures of the pure polymer and pure diluent, and w_1 and w_2 are their respective weight fractions in the mixture. For a copolymer, w_1 and w_2 refer to the weight fraction of the two comonomers, whereas $T_g(1)$ and $T_g(2)$ refer to the glass temperatures of the two corresponding homopolymers. This equation may be expected to apply to systems which are compatible and not too strongly polar. Data on copolymers and on polymer-diluent systems illustrate that this is substantially true.

J6. Glass Temperatures of Poly-(Chlorotrifluoroethylene), Poly-(Vinylidene Fluoride), and their Copolymers.* L. MANDELKERN, G. M. MARTIN, AND F. A. QUINN, JR., *National Bureau of Standards.*—The glass temperatures of poly-(chlorotrifluoroethylene), poly-(vinylidene fluoride), and five of their copolymers of varying composition were determined using volume dilatometers and an automatic recording interferometer. The glass temperatures for the two homopolymers were found to be in the range +30° to 35°C for poly-(chlorotrifluoroethylene) and −25° to −30°C for poly-(vinylidene fluoride). A quenched sheet of poly-(chlorotrifluoroethylene) originally formed by compression molding displayed a 1% increase in thickness on initial heating above 30°C but this phenomenon did not manifest itself on subsequent cooling and heating cycles. The glass temperatures T_g, of the copolymers ranged between the values of the two homopolymers. However, in order for the simple linear relation $1/T_g = w_1/T_{g_1} + w_2/T_{g_2}$, to be obeyed, where w_1 and w_2 are the weight fractions of the two components, and T_{g_1} and T_{g_2} the glass temperatures of the respective homopolymers, the required glass temperature for poly-(vinylidene fluoride) would be about 15° lower than observed. The effect of crystallization on the glass temperature of a copolymer will also be discussed.

* Supported in part by the Quartermaster Research and Development Command, Rubber Branch.

J7. Dilatometric Measurements on Gels of Cellulose Tributyrate and Cellulose Nitrate. M. N. VRANCKEN AND JOHN D. FERRY, *University of Wisconsin.*—The thermal expansion of gels of cellulose tributyrate in dimethyl phthalate and cellulose nitrate in diethyl phthalate has been studied over a temperature range from 155°K to room temperature, using Pyrex dilatometers with long capillary tubes and 2,3-dimethyl pentane as a confining liquid. Values of the glass transition temperatures (T_g) and of the thermal expansion coefficients above and below T_g have been determined. For cellulose tributyrate gels, T_g decreases with decreasing polymer concentration. Below 20% polymer, measurements became impossible, because of partial freezing out of solvent. For cellulose nitrate, over a concentration range from 37% to 12%, T_g goes through a minimum with decreasing polymer concentration.

J8. Hydrodynamic and Thermal Behavior of a Plastic Column. S. BROERSMA, *Northwestern University.*—The low value of Reynold's number and the low heat conductivity make it necessary to analyze the flow of hot plastic on the basis of a layer system. Thus a roll resting on two calenders, one of which is at rest, can be divided into a center core, an outside layer penetrating the nip and a thin coating sheared off by the web. The observed flow pattern of the longlived core can be understood on the basis of Newtonian hydrodynamics. Taking into account an exponential temperature dependence of the viscosity, instabilities in the temperature are theoretically predicted. The time constant is of the order of an hour. Most of the heat development and force action takes place in the outside layer reaching deep into the nip. The fact that the bare rolls do not allow plastic to pass indicates that the increase in shear stress with depth cannot be matched by outside forces so that sliding does occur. The relationship observed between the force keeping the rolls together and the thickness of the film passing with the web can be explained with a viscosity varying as $(\tau_0/\tau)^n \exp -p/p_0$. In the case of polyethylene, $\tau_0=0.5$ atmos, $n=1$, $p_0=50$ atmos apply. Irregularities in the plastic coating affecting a technical process, can be related to the existence of layers of different temperature.

J9. Kinematographic Study of Tensile Fracture in Polymers. A. M. BUECHE AND A. V. WHITE, *General Electric Research Laboratory.*—High-speed motion pictures were taken of silicone rubber, irradiated polyethylene, Plexiglas II, and aluminum foil while they were being broken. Fractures started internally in some of the silicone samples but at the edges of all of the others. The rates of crack growth and the rates of retraction of the ends of the rubber samples were measured. The velocities with which the cracks grew were compared with the results of the theories of Poncelet and Yoffe. Their prediction, that the velocities should be about one-half those of transverse waves in the media, was found to represent the data for materials with moduli differing by five decades. After fracture, the ends of the rubber samples contracted with velocities approximately equal to the velocities of longitudinal waves in these samples.

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THE GLASS TRANSITION TEMPERATURES OF POLYMERS

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A. DEFINITIONS OF THE GLASS TEMPERATURE (T_g)

A wide range of polymer transition temperatures are reported in the literature. They appear under a variety of names, e.g., T_g (sometimes as glass-to-rubber transition temperature, or just glass temperature), dynamic T_g, mechanical T_g, glass-to-glass transition temperature (T_{gg}), low temperature TT, first-order TT, second-order TT, brittle temperature (T_b), melting point (T_m), polymer melt temperature (PMT), softening point (SP), flow temperature (T_f), freezing temperature, stiffness temperature, temperature of 10% tensile retraction, heat deflection and distortion temperatures (HDT), and α, β, γ etc. relaxations and dispersion temperatures. Unfortunately, some of these terms mean different things to different people. Thus one SP may lie very close to T_g and another to T_m while T_b may be a T_{gg} in one case yet analogous to T_g in another. All of these TT appear in the literature so an account of the meanings of the amorphous phase transitions and of factors governing them is relevant here.

Many properties are affected at the T_g so definitions in terms of the property changes are numerous; the principal definitions are usually expressed in thermodynamic terms or in terms of physical property changes.

The T_g of a polymer is a characteristic of the amorphous (non-crystalline) region; this region possesses the amorphous X-ray diffraction pattern of a liquid above and below T_g (44). At the T_g, a discontinuity occurs in the temperature (and pressure) derivatives of the energy, heat content, entropy, and volume, but these quantities are continuous functions of temperature (46); for this reason T_g has been referred to as a second-order transition though it only has some of the characteristics of such a transition. There is an abrupt increase in the coefficient of expansion and specific heat, but no absorption of latent heat, when a polymer is heated through the T_g region.

In terms of physical property changes, the T_g is often taken as the mid-point of the temperature interval over which the discontinuity takes place, but this is not necessarily so as some authors adopt other conventions.

The T_g is interpreted in terms of molecular behaviour as the temperature above which the polymer has acquired sufficient thermal energy for isomeric rotational motion, or for significant torsional oscillation to occur about most of the bonds in the main chain which are capable of such motion in the undegraded molecule. This definition, in referring to "most" of the bonds instead of "all" of the bonds in the main chain places so-called liquid-liquid transitions, of the type which occur in polystyrene (47) at 160°C, above T_g. Constraints to motion can arise from the barrier to rotation which in turn is raised by increasing the magnitude of cohesive forces, including hydrogen bonding, or from steric interactions. Below T_g, segmental motion takes place relatively infrequently and the majority of in-chain groups have fixed conformations. The T_g is usually unambiguous because considerable cooperation between neighbouring segments is required to effect rotational motion about a long sequence of in-chain bonds, the situation being analogous to the interaction of a set of engaging cog-wheels.

Unfortunately, these definitions, while serving to locate transitions, do not provide adequate criteria for T_g. For example, on a rising temperature scale, T_g could be the lowest or the highest amorphous transition, or the one which accompanied the biggest change in properties. It could further be specified that the transition should be of the glass to liquid type. None of these definitions find general acceptance and therefore when multiple transitions occur, but no clear T_g emerges, it is best to report all of the significant amorphous transitions.

The molecular mechanism of amorphous transitions (T_{gg} below T_g involves rotational motion but to a greatly limited degree. Short-range co-operative motions can occur along the main-chains of polymers, but the commonest form of motion is that involving side-group rotational isomerism.

The terms α, β, or γ, etc are often used to discriminate between multiple relaxations in polymers. The transition occurring at the highest temperature is usually denoted as α, the next β and so on. Frequently, therefore, α-relaxations are T_m, β-relaxations are T_g, and γ-relaxations are T_{gg}. With increasing usuage of β for T_g a T_g may be referred to as a β-relaxation even though a higher transition is not reported. T_g is, moreover, associated with the α-relaxation in some works.

Other terms for transitions, notably SP, PMT, T_f, and HDT could be T_g or T_m; freezing temperatures and stiffness temperatures are usually in the vicinity of T_g. Further test results are usually required to define these transitions in terms of their relevance to the amorphous or crystalline regions but in the absence of more specific information some such data is included in the tables which follow with a clear indication of its origin in such measurements.

B. DATA ASSESSMENT AND FACTORS AFFECTING T_g

Though the factors which govern T_g have been known for some years, there is still a wide spread in reported data on particular polymers. The distinction between polymers containing diluents, and/or having an unknown molecular weight distribution, and well-characterised polymers, with persistent (or limiting) properties (see section (6)) is too infrequently drawn. Polymer T_gs are frequently sensitive to parameters which are varied, so the provision of reliable data requires an analysis of the published values in terms of all the factors which affect T_g. The main factors are now outlined so that reliability may be judged independently; more detailed treatments are published in reviews (6, 43, 49).

(1) Structure

Most polymer structures would be difficult to prove in detail and thus they are idealised and presumed from the characteristics of the reactants rather than proved by chemical and structural analysis. Structural uncertainties can arise both from the multiplicity of chemical reactions which may occur during polymerization processes, especially those taken to high conversions, and from the structure of the reactants themselves. For example, if a polymer possesses an asymmetric in-chain tetravalent atom, then the structure may be stereoregular to some degree in one or more of a variety of possible forms.

Alternatively, a polymer containing a residual double bond in the repeating unit could be in a cis, or trans, conformation. Polymers of 1,3-dienes can have various combinations of cis, trans, 1,2- or 1,4-structures. Variations in these structural features can have a large effect on T_g data. Despite these uncertainties, the data are often useful if they can be regarded as reliably pertaining to a polymer with reproducible properties and so data are reported here on many polymers of uncertain structure.

(2) Crystallinity

The T_g of a semicrystalline polymer is a characteristic of the amorphous region and this has led some workers to suggest that the presence of crystallinity does not appreciably affect T_g. However, it seems possible that the steric constraint imposed by crystalline regions on neighbouring, otherwise-mobile polymer segments might result in an increase in T_g. It is found that with increasing crystallinity polymer T_gs may be little affected (50), may increase (51, 52) (at least for isothermal crystallisation (53)) or may decrease (51, 54). Wherever possible therefore the effect of variations in the degree of crystallinity on T_g should be measured and reported. T_g values selected in this work are the highest quoted on the sample with the lowest degree of crystallinity, other factors being equal.

(3) Dynamic Measurements and Rate Effects

Rate effects are of three kinds. The first is associated with the rate of heat transfer to or from a sample, the second with the rate of attainment of equilibrium at the temperature imposed, and the third with the rate of response to an applied electrical or mechanical stress. These effects are considered in turn.

Fast heating or cooling rates, obviously may not permit the whole of a polymer sample to attain temperature equilibrium with its environment, particularly near and below the T_g where relaxation processes are very slow. In practice, the best criteria for a suitable heat transfer rate is that halving, or doubling it has no significant effect on the results. Reliable results are obtained using a rising temperature scale of about 1°C/h and for many polymers the same results, within 2°C, can be obtained using heating rates of 3°C/h. True equilibrium results are very difficult to attain near T_g and very slow, isothermal drifts in volume, heat content etc. occur over long time periods. In the interests of time-saving, it is nearly always necessary to extrapolate results in the vicinity of T_g but corrections for rate may be applied (55-57). To put T_g values on a comparable basis it is clear that many published T_gs need correcting for rate. In this study, where it is expected that rate effects might have caused a shift in T_g value, the heating rate is given specifically or as that rate to be associated with a particular method of measurement.

Methods of determining T_g which involve high rates of application of electrical or mechanical stress often provide T_g values 20° or more above those determined dilatometrically. Various approximations to correct for frequency effects are available (58-60), but the correct form of extrapolation to low frequencies is open to question and is certainly structure-dependent. Dynamic measurements made at frequencies near 1Hz often correspond to dilatometric measurements made at heating rates of 3°C/h. In assessing T_g values, priority has been given to data obtained at the slowest heating rates and lowest frequencies but no corrections for rate variation have been applied. In the data tables which follow, however, the use of a dynamic method is recorded when its use is reported.

(4) Static Methods of Measurement

Clearly, no measurement can be conducted at zero rate but at least twenty relatively static, as opposed to dynamic, or high frequency, methods have been used in the determination of T_gs. Many of these are variants of the same principle, for example, the β-ray transmission method (61) is based on the change in dimensions of the sample on heating rather than on a change in β-ray transmission characteristics. Other techniques include dilatometry (10-12), dilatometry by differential pressure measurements (62), dilatometry under pressure (63, 64), buoyancy (13, 14), expansivity (15, 16), optical (65), x-ray diffraction (66-68), refractometry (27, 29), (laser) (69), calorimetry and differential scanning calorimetry (DSC) (57, 70-72), differential thermal analysis (DTA) (73-75), resistivity (76, 77), penetrometry (78, 79), T_b measurements (18, 80-82), SP measurements (83), infrared spectrometry (84, 85), radiothermoluminescence (86, 87), and o-positronium decay (88, 89). Recent methods claimed as relevant for T_g and/or TT measurement, include Rayleigh scattering (90), Landau-Placzek ratio (69, 91, 49), craze relaxation (37), chromatography (92, 93), current glow (94) and depolarisation current (95). Length/temperature measurements (15) are less reproducible than volume methods, especially when the polymer is orientated, or when internal stresses are present. T_gs from refractive index and dilatometric measurements agree well. Mechanical techniques, such as penetrometer, T_b etc. measurements can give high or low results, but correlations with T_gs determined dilatometrically can be established (72, 83, 96). In the following tables, when it is known that mechanical techniques have been used for measuring T_g data recorded the fact is noted against the data.

A further disparity in published data, mentioned earlier arises from variations in the criteria used for selecting the T_g when, as usually occurs, results are obtained in the form of a curve showing an inflection region. In dynamic mechanical loss and dielectric loss measurements T_g is often assumed to coincide with the peaks of graphs showing the variation of these parameters with temperature; this temperature usually coincides with the mid-point of the region in a graph of modulus or dielectric constant against temperature where a significant fall in the magnitude of these quantities occurs. In the case of DSC and DTA data some authors prefer to take the inception of the inflection as T_g (97). Frequently, the criteria adopted are not stated.

(5) Diluents

Much of the divergence in published T_g data is caused by the use of impure samples. Common impurities are unpolymerised monomer, low molecular weight polymer, solvents, and water. Great care should be taken to remove such impurities because their presence in small concentrations can lead to a shift (48, 98-103) in T_g of over 40°C and sometimes the occurrence of "diluent transitions" for example "water peaks". A full description in the original publication of the precautions taken to exclude diluents in the preparation of samples is necessary if the validity of published results is to be properly assessed. As these descriptions have usually been omitted there is some uncertainty attached to such reported data and they should strictly be regarded as only provisional.

(6) Molecular Weight

The T_g of a regular homopolymer generally increases up to a limiting value, known as the limiting or persistent T_g value, with increase in molecular weight (48, 104, 105) but the reverse may hold for polymers with particular end-groups (106), or where crystallinity decreases with increasing molecular weight (107). For some polymers, T_gs are said to be independent of molecular weight (108).

Many data, especially on condensation polymers, relate to polymers of rather low molecular weight and it seems likely that higher T_g values would be obtained were higher molecular weight polymers available. Many polymers are not properly characterised with respect to molecular weight and the only measure of molecular weight is a viscosity value which itself can be very dependent on solvent/polymer interactions and to some extent temperature. In the absence of better criteria it has been assumed, other factors being equal, that the highest viscosities and the highest molecular weight polymers are associated with the most reliable data.

(7) Thermal History

Ideally, polymer samples for T_g measurements should be amorphous, free from internal stress, and unoriented. T_g measurements should be made on samples which have been melted, rapidly quenched, and, if practicable, annealed for at least thirty minutes at some 20°C above the T_g, but below the crystallisation temperature range. It is important that the T_g should be shown to be reproducible after repeated annealing and that the period between measurements at all temperatures, including room temperature should be recorded. In certain polyamides, heat treatment can cause the disappearance of a TT but the TT can reappear after storage for several days at RT (75).

(8) Pressure

Increasing pressure increases T_g at about 0.025°C per bar (48) and therefore the effect is negligible up to imposed pressures of about 40 bars.

The foregoing remarks emphasize the need for considerable caution in the determination of T_g and show why many literature values should be regarded as the most reliable values available rather than fully authenticated; extensive experimentation is required (6) to fully satisfy the criteria for T_g. In this study, the T_g values quoted have been selected using the criteria outlined in the previous discussion but it should be noted that these values are not necessarily comparable. Consideration must be given to all factors which govern T_g and suitable corrections applied before data become comparable. Details of all the data relevant to such an assessment, and covering all TT data will be published in the fuller study mentioned earlier (43). The references cited here indicate all the papers which have been considered in allocating T_g values but not all of the papers quote the value adopted.

C. CLASSIFICATION AND NOMENCLATURE

A vast amount of data has been published in over 10,000 papers which form the subject of a special study (43) of all TTs to be published separately. This present Section of the Polymer Handbook represents a preliminary survey only of the T_g field.

The data in the tables which follow is restricted to undiluted linear homopolymers. This definition excludes nearly all polymers (44) and therefore requires qualification. The term "undiluted" here means that no extraneous materials of any kind have been added to the polymer and the term ' linear homopolymer' refers to a homopolymer prepared from difunctional reagent(s), which is expected from its mode of synthesis to have a predominantly regular, not unintentionally branched, repeating unit (44). Such a polymer is essentially represented by its chemical structural formula and/or the polymer name.

Polymers are subdivided into principle classes of increasing seniority substantially in accordance with the recommendations of the editors. Heterocyclics being most senior are found at the end of the table. All polymers are placed in the most senior class their structure commands and appear in only one class. Polymers containing heterocyclic rings in the main-chain are arranged in decreasing order of seniority of the most senior main-chain heterocyclic ring (109, 110). This results in the order represented in the table of contents. With the exception of the most common polymers with accepted trivial names, the polymers are named substantially according to the ACS recommendations for polymer nomenclature (110) in conjunction with IUPAC rules (109); less common polymers are cross-referenced from the trivial to the systematic name. Systematic names are not given for all the polymers in order to save space. Substitutive nomenclature is generally used for simple radicals, but for long combinations of radicals, replacement nomenclature has been used to provide a much shorter name (as for some fluoroacrylates with ether side chains). When sequences of radicals have repeated, the repeating sequence has been written once and prefixed "di", "tri" etc. as appropriate, for example di(oxyethylene) for the sequence $-O-CH_2-CH_2-O-CH_2-CH_2-$. Note that the diradical "di(oxyethylene)" must be distinguished from the diradical "dioxyethylene" which has the structure $-O-O-CH_2-CH_2-$, and also the diradical "ethylenedioxy" which has the structure $-O-CH_2-CH_2-O-$ (IUPAC rule C205.2). The principle underlying the last-named diradical has not generally been extended to the naming of polymers in this section, i.e. diradicals of structure -X Y-X- are not named YdiX, with the exception of alkanedioyl diradicals, because of the difficulty of locating indexed polymer names in which the diradicals are not named from left to right. Many polymers are derivatives of the diradical "propylene" $-CH(CH_3)-CH_2-$; the substituted diradical has been employed in naming polymers instead of "1-methylethylene" which could be preferred.

Polymer names are tabulated in alphabetical order within each subsection, but

1. multiplying prefixes and prefixes like sec-, tert-, including designated atoms and the numbers showing locations of substituents are ignored except as secondary and tertiary indicators of order thus "8-ferrocenyl-3-methyl" comes before "1,2-dimethyl-1-butenylene",
2. monosubstituents are placed before polysubstituents, thus "methyl" comes before "dimethyl", but "tetramethyl" is alphabetically placed before "trimethyl",
3. the locations of substituents in otherwise identical polymers are taken as tertiary indicators of order: the numbers are arranged in increasing order at the first point of difference. Thus, 2,3,8- comes before 2,4,1-.

The authors gratefully acknowledge the assistance of Miss S. A. Watts.

D. TABLE OF GLASS TRANSITION TEMPERATURES OF POLYMERS

Polymer		T_g(K)	Remarks	References
1. Main-chain Acyclic Carbon Polymers				
1.1 Poly(dienes)				
Natural rubber	see Poly(isoprene) cis			
Neoprene	see Poly(1-chloro-1-butenylene)			
Poly(butadiene)s	see Poly(1-butenylene)s & poly(vinylethylene)			
Poly(1-butenylene)	cis	171		26,61,574-597
	trans	215	Wide spread in published data	580,583,585-587,589 594,595,598,599
Poly(1-butyl-1-butenylene)		192	Dynamic method	600
Poly(1-tert-butyl-1-butenylene)		293		80,348,601,602
Poly(2-chloro-1,3-butadiene)	see Poly(1-chloro-1-butenylene)			
Poly(1-chloro-1-butenylene)	cis	253		603
	trans	233		1,24,604-611
Poly(2-chloro-1,4,4-trifluoro-1-butenylene)		256	No experimental details	587
Poly(1-decyl-1-butenylene)		220		1
Poly(1-ethyl-1-butenylene)		197		600,612
Poly(1,4,4-trifluoro-1-butenylene)		238	Slightly crystalline	587
Poly(octafluoro-4-methyl-1-butenylene)		270	DSC heating rate	97
Poly(1-heptyl-1-butenylene)		190		80,601
Poly(isoprene)	cis	200		349,388,394,464,469, 574,591,594,595,613-623
	trans	215		514,581,589,594,608, 617,624
Poly(1-isopropyl-1-butenylene)		221		600,601,612
Poly(4-methoxy-1-butenylene)		256		591
Poly(4-methoxycarbonyl-3-methyl-1-butenylene)		326	Dynamic method	625
Poly(1,2-dimethyl-1-butenylene)		262		576
Poly(methyl sorbate)	see Poly(4-methoxycarbonyl-3-methyl-1-butenylene)			
Poly(1-pentenylene)	cis	159	Heating rate 16 K/min	626
	trans	183	DTA heating rate	594
Poly(1-phenyl-1-butenylene)		~ 283	Low molecular weight	584
Poly(1-propyl-1-butenylene)		196		600
Poly(vinylethylene)	atactic	269	Published values, range from 245 to 283 K	585,586,592,597
	syndiotactic	245		627,628
1.2 Poly(alkenes)				
Poly(butene-1)	see Poly(ethylethylene)			
Poly(butylethylene)		223		1,272,574,629-633
Poly(tert-butylethylene)		337	Softening point, highly crystalline sample	631
Poly(cyclohexylethylene)	atactic	393		634-639
	isotactic	406	Dynamic method	640
Poly(2-cyclohexylethylethylene)		313	Mechanical method	634
Poly[(cyclohexylmethyl)ethylene]		348	Mechanical method	634
Poly(3-cyclohexylpropylethylene)		248	Softening point, comparative data reported	631
Poly(cyclopentylethylene)		348	Dynamic method	634
Poly[(cyclopentylmethyl)ethylene]		333	Mechanical method	634
Poly(decylethylene)		237		629,632,641
Poly(dodecylethylene)		241		629,632,641
Poly(ethylene)		148	Conflicting interpretations of data; branch point transition at 252 K	1,6,16,28,61,80,191, 223,238,261,262,272, 317,318,344,349,395, 396,469,521-523,574, 589,592,608,629,641-676

	Polymer	T_g(K)	Remarks	References
1.2	Poly(alkenes) (Cont' d.)			
	Poly(ethylethylene)	249	Wide spread in reported values	1,61,67,273,349,395,397,574,629,632,641,645,646,677-680
	Poly(1-ethyl-1-methyltetramethylene)	~ 250	DTA heating rate	681
	Poly(ethyl-2-propylene)	268	Dynamic method	682
	Poly(heptylethylene)	226	Dynamic method	629
	Poly(hexadecylethylene)	328	Dynamic method, stereoregular sample; may be first-order transition	629,641,683
	Poly(hexylethylene)	In range 208 to 228	Conflicting data	1,574,629,632
	Poly(isobutylene) see Poly(1,1-dimethylethylene)			
	Poly(isobutylethylene)	302	Reported values range from 297-333 K	1,51,675 684-692
	Poly(isohexylethylene)	239	Softening point	631
	Poly(isopentylethylene)	259	Softening point	631
	Poly(isopropylethylene) atactic	323	Dynamic method	634,641,685,691,692,
	isotactic	367	Dilatometry; suggested transition crystal/crystal type	693
	Poly(3,3-dimethylbutylethylene)	326	Softening point	631
	Poly(methylene)	155		215,238,262,398,574,694
	Poly(1,1-dimethylethylene)	200		1,23,24,58,61,216,223,695-704
	Poly(1-methyloctamethylene)	215	Heating rate 4-8K/min	705
	Poly(1,1-dimethyltetramethylene)	253	Dynamic method	706
	Poly(1,1-dimethyltrimethylene)	263	Dynamic method	706-709
	Poly(1,1,2-trimethyltrimethylene)	310		682
	Poly(4-methylpentene-1) see Poly(isobutylethylene)			
	Poly(4,4-dimethylpentene-1) see Poly(neopentylethylene)			
	Poly(4,4-dimethylpentylethylene)	313	Softening point, crystalline sample	631
	Poly(neopentylethylene)	332	Softening point, crystalline sample	631
	Poly(nonylethylene)	236		632
	Poly(octylethylene)	232		629,632,641
	Poly(pentylethylene)	242	Dynamic method	629
	Poly(propylene) atactic (a)	~ 260	Conflicting data; most values reported range (a) 258 to 270 (b) 238 to 260 (c) 263 to 267 K	1,6,15,61,80,122,191,223,261,272,273;282,318,326,394-397,469,574,615,629,632,641,645,646,659,666,668,675,677,678,684,710-726
	isotactic (b)	~ 265		
	syndiotactic (c)	~ 265		
	Poly(propylethylene)	~ 233	Conflicting data	1,272,574,595,629,630,632,645,685,727
	Poly(propyl-2-propylene)	300	Dynamic method	682
	Poly(tetradecylethylene)	246		629,632,641
1.3	Poly(acrylics) and Poly(methacrylics)			
1.3.1	Poly(acrylic acid) and Poly(acrylic acid esters)			
	Poly(acrylic acid)	379		720,811-818
	Poly(benzyl acrylate)	279		746
	Poly(4-biphenylyl acrylate)	~ 383		819
	Poly(4-butoxycarbonylphenyl acrylate)	286		746
	Poly(butyl acrylate)	219	Mechanical method	1;23,634,775,820-822

	Polymer		T_g(K)	Remarks	References
1.3.1	Poly(acrylic acid) and Poly(acrylic acid esters) (Cont' d.)				
	Poly(sec-butyl acrylate)	conventional	251		823, 824
		syndiotactic	253		
		isotactic	250		
	Poly(tert-butyl acrylate)		380, 316, 346	Conflicting data	746, 824, 825
	Poly(2-tert-butylphenyl acrylate)		345		826
	Poly(4-tert-butylphenyl acrylate)		344		826
	Poly(cesium acrylate)		447	Extrapolated from DSC data on water plasticised samples	817
	Poly[3-chloro-2, 2-bis(chloromethyl)propyl acrylate]		319		746
	Poly(2-chlorophenyl acrylate)		326		746
	Poly(4-chlorophenyl acrylate)		331		826
	Poly(2, 4-dichlorophenyl acrylate)		333		746
	Poly(pentachlorophenyl acrylate)		420		746
	Poly(4-cyanobenzyl acrylate)		317		746
	Poly(4-cyanobutyl acrylate)		233-238	No experimental details	827
	Poly(2-cyanoethyl acrylate)		277		746, 820
	Poly(cyanomethyl acrylate)		296	No experimental details	820
	Poly(5-cyano-3-oxapentyl acrylate)		250	No measurement details	820
	Poly(4-cyanophenyl acrylate)		363		746
	Poly(4-cyano-3-thiabutyl acrylate)		249		828
	Poly(6-cyano-3-thiahexyl acrylate)		215		828
	Poly(6-cyano-4-thiahexyl acrylate)		215		828
	Poly(8-cyano-7-thiaoctyl acrylate)		214		828
	Poly(5-cyano-3-thiapentyl acrylate)		223		828
	Poly(cyclohexyl acrylate)	conventional	292		824
		syndiotactic	289		
		isotactic	285		
	Poly(dodecyl acrylate)		270	Brittle point	821, 829
	Poly(2-ethoxycarbonylphenyl acrylate)		303		746
	Poly(3-ethoxycarbonylphenyl acrylate)		297		746
	Poly(4-ethoxycarbonylphenyl acrylate)		310		746
	Poly(2-ethoxyethyl acrylate)		223		830
	Poly(3-ethoxypropyl acrylate)		218		830, 831
	Poly(ethyl acrylate)	conventional	249		23, 634, 775, 820, 821, 824, 832, 833
		syndiotactic	249		
		isotactic	248		
	Poly(2-ethylbutyl acrylate)		223	Brittle point	823
	Poly(2-ethylhexyl acrylate)		223	Brittle point	821
	Poly(ferrocenylethyl acrylate)		430	No experimental details	834
	Poly(ferrocenylmethyl acrylate)		470-483	DSC heating rate	835
	Poly(1H, 1H-heptafluorobutyl acrylate)		243		155, 836, 837
	Poly(1H, 1H, 3H-hexafluorobutyl acrylate)		251		836
	Poly(2, 2, 2-trifluoroethyl acrylate)		263		836
	Poly[2, 2-difluoro-2-(2-heptafluorotetrahydrofuranyl)ethyl acrylate]		275	Brittle temperature	830
	Poly(1H, 1H-undecafluorohexyl acrylate)		234		836
	Poly(fluoromethyl acrylate)		288	Estimated T_g	838
	Poly(1H, 1H-pentadecafluorooctyl acrylate)		256	Crystalline	836
	Poly(5, 5, 6, 6, 7, 7, 7-heptafluoro-3-oxaheptyl acrylate)		228		830
	Poly(1H, 1H-undecafluoro-4-oxaheptyl acrylate)		205		830
	Poly(1H, 1H-nonafluoro-4-oxahexyl acrylate)		224		830
	Poly(7, 7, 8, 8-tetrafluoro-3, 6-dioxaoctyl acrylate)		233		830
	Poly(1H, 1H-tridecafluoro-4-oxaoctyl acrylate)		205		830
	Poly(2, 2, 3, 3, 5, 5, 5-heptafluoro-4-oxapentyl acrylate)		218		830, 837
	Poly(4, 4, 5, 5-tetrafluoro-3-oxapentyl acrylate)		251		830
	Poly(5, 5, 5-trifluoro-3-oxapentyl acrylate)		235		830
	Poly(1H, 1H-nonafluoropentyl acrylate)		236		836
	Poly(1H, 1H, 5H-octafluoropentyl acrylate)		238		836
	Poly(heptafluoro-2-propyl acrylate)		278-283	No details on sample or measurement	839
	Poly(1H, 1H-pentafluoropropyl acrylate)		247		836
	Poly(heptyl acrylate)		213	Brittle point	821
	Poly(2-heptyl acrylate)		235	Brittle point	823

	Polymer		T_g(K)	Remarks	References
1.3.1	Poly(acrylic acid) and Poly(acrylic acid esters) (Cont' d.)				
	Poly(hexadecyl acrylate)		308	Brittle point	23,821,840,841
	Poly(hexyl acrylate)		216	Brittle point	823
	Poly(isobornyl acrylate)	conventional	367		824
		syndiotactic	369		
		isotactic	363		
	Poly(isobutyl acrylate)		249	Brittle point	823
	Poly(isopropyl acrylate)	conventional	267-270		746,823,824
		syndiotactic	271-284		
		isotactic	262		
	Poly(1,2:3,4-di-O-isopropylidene-α-D-galactopyranos-6-O-yl acrylate)		371		11,842
	Poly(magnesium acrylate)		673	Estimated from copolymer data	843
	Poly(3-methoxybutyl acrylate)		217		844
	Poly(2-methoxycarbonylphenyl acrylate)		319		746
	Poly(3-methoxycarbonylphenyl acrylate)		311		746
	Poly(4-methoxycarbonylphenyl acrylate)		340		746
	Poly(2-methoxyethyl acrylate)		223		830
	Poly(4-methoxyphenyl acrylate)		324		826
	Poly(3-methoxypropyl acrylate)		198		830
	Poly(methyl acrylate)	conventional	283		18,22,23,81,576,720,775-777,821,824,831,841,845-848
		head to tail	278		
		head to head	304		
	Poly(3,5-dimethyladamantyl acrylate)		379	DSC heating rate: data corrected (sic)	849,850
	Poly(3-dimethylaminophenyl acrylate)		320		746
	Poly(2-methylbutyl acrylate)		241	Brittle point	823
	Poly(3-methylbutyl acrylate)		228	Brittle point	823
	Poly(1,3-dimethylbutyl acrylate)		258	Brittle point	823
	Poly(2-methyl-7-ethyl-4-undecyl acrylate)		253	Brittle point	823
	Poly(2-methylpentyl acrylate)		235	Brittle point	823
	Poly(2-naphthyl acrylate)		358		826
	Poly(neopentyl acrylate)		295		746
	Poly(nonyl acrylate)		215	Brittle point	821
	Poly(octyl acrylate)		208	Brittle point	821,841
	Poly(2-octyl acrylate)		228	Brittle point	823
	Poly(3-pentyl acrylate)		267		746,823
	Poly(phenethyl acrylate)		270		746
	Poly(phenyl acrylate)		330		746,826
	Poly(potassium acrylate)		467	Extrapolated from data on water plasticised samples	817
	Poly(propyl acrylate)		236	Brittle point	23,592,832,836,851,852
	Poly(sodium acrylate)		503	Estimated from copolymer data	817,843
	Poly(tetradecyl acrylate)		297	Brittle point; probably 1st order transition	23,821
	Poly(3-thiabutyl acrylate)		213		831
	Poly(4-thiahexyl acrylate)		197		831
	Poly(5-thiahexyl acrylate)		203		831
	Poly(3-thiapentyl acrylate)		202		831
	Poly(4-thiapentyl acrylate)		208		831
	Poly(m-tolyl acrylate)		298		826
	Poly(o-tolyl acrylate)		325		826
	Poly(p-tolyl acrylate)		316		826
1.3.2	Poly(acrylamides)				
	Poly(acrylamide)		438	No experimental details	820
	Poly(N-butylacrylamide)		319	Mechanical method	853
	Poly(N-sec-butylacrylamide)		390	No experimental details	820
	Poly(N-tert-butylacrylamide)		401	No experimental details	820
	Poly(N,N-dibutylacrylamide)		333	Softening point, amorphous	854
	Poly(N-dodecylacrylamide)		198-320	Conflicting data, 198K more probable in "amorphous sample"	820,853

	Polymer		T_g(K)	Remarks	References
1.3.2	Poly(acrylamides) (Cont' d.)				
	Poly(isodecylacrylamide)		313	No experimental details	820
	Poly(isohexylacrylamide)		344	No experimental details	820
	Poly(isononylacrylamide)		325	No experimental details	820
	Poly(isooctylacrylamide)		339	No experimental details	820
	Poly(N-isopropylacrylamide)		358, 403	Conflicting data	820, 855
	Poly(N, N-diisopropylacrylamide)		$\sim$ 393	Softening point, almost amorphous	854
	Poly(N, N-dimethylacrylamide)		362		746
	Poly[N-(1-methylbutyl)acrylamide]		380	No experimental details	820
	Poly(N-methyl-N-phenylacrylamide)		$\sim$ 453	Softening point, amorphous	854
	Poly(morpholylacrylamide) [Poly(morpholinocarbonylethylene)]		420		9, 856
	Poly(N-octadecylacrylamide)		162	Mechanical method	853
	Poly(N-octylacrylamide)		220		853
	Poly(piperidylacrylamide)		381		9, 856
1.3.3.	Poly(methacrylic acid) and Poly(methacrylic acid esters)				
	Poly(adamantyl methacrylate)		414	DSC heating rate	849
	Poly(benzyl methacrylate)		327		746
	Poly(2-bromoethyl methacrylate)		325		746
	Poly(2-N-tert-butylaminoethyl methacrylate)		306		746, 857
	Poly(butyl methacrylate)	atactic	293	Range from $\sim$286 to 308K	22, 69, 272, 695, 720, 775, 822 824, 847, 858-862
		isotactic	249		824
	Poly(sec-butyl methacrylate)		333		746, 863
	Poly(tert-butyl methacrylate)	atactic	391	Maximum value	746, 847, 864
		syndiotactic	387	Maximum value	
		isotactic	280		
	Poly(2-chloroethyl methacrylate)		$\sim$ 365	Likely to be slightly high	262
	Poly(2-cyanoethyl methacrylate)		364		746, 865
	Poly(4-cyanomethylphenyl methacrylate)		$\sim$ 401		746
	Poly(4-cyanophenyl methacrylate)		428		746
	Poly(cyclohexyl methacrylate)	atactic	356		263, 353, 820, 824, 847, 862
		isotactic	324		23, 821, 840, 846
	Poly(decyl methacrylate)		203		
	Poly(dodecyl methacrylate)		208	Conflicting data	1, 821, 858, 866, 867
	Poly(diethylaminoethyl methacrylate)		$\sim$ 289-297		857
	Poly(2-ethylhexyl methacrylate)		263	Brittle point	821
	Poly(ethyl methacrylate)	atactic	338	Data covers range 320-343K	22, 69, 286, 352, 353, 521, 695, 821, 824, 857, 858, 860, 862, 868-874
		isotactic	285		824
		syndiotactic	339		847
	Poly(2-ethylsulfinylethyl methacrylate)		298		746
	Poly(ferrocenylethyl methacrylate)		482	No experimental details	834
	Poly(ferrocenylmethyl methacrylate)		$\sim$ 458-468	DSC heating rate	835
	Poly(1H, 1H-heptafluorobutyl methacrylate)	syndiotactic	$\sim$ 330		875
	Poly(1H, 1H, 7H-dodecafluoroheptyl methacrylate)		286	Mechanical method	876
	Poly(1H, 1H, 9H-hexadecafluorononyl methacrylate)		258	Mechanical method	876
	Poly(1H, 1H, 5H-octafluoropentyl methacrylate)		309	Mechanical method	876
	Poly(1, 1, 1-trifluoro-2-propyl methacrylate)		354	Vicat softening temperature	863
	Poly(hexadecyl methacrylate)		288	Brittle point, sample probably crystalline - may be T_m	821, 866
	Poly(hexyl methacrylate)		268		695, 846, 858, 877
	Poly(2-hydroxyethyl methacrylate)		328, 359	Conflicting data	746, 878-880
	Poly(2-hydroxypropyl methacrylate)		349		846, 878
	Poly(isobornyl methacrylate)		383		824
	Poly(isobutyl methacrylate)	random	326		746, 821, 824
		isotactic	281		846, 881
		80% syndiotactic, 20% isotactic	326		

	Polymer		T_g(K)	Remarks	References
1.3.3	Poly(methacrylic acid) and Poly(methacrylic acid esters) (Cont' d.)				
	Poly(isopropyl methacrylate)	atactic	354		746, 824, 862
		isotactic	300		
		syndiotactic	358		
	Poly(1,2:3,4-di-O-isopropylidene-α-D-galactopyranos-6-O-yl methacrylate)		399		11, 842
	Poly(2,3-O-isopropylidene-DL-glyceritol-1-O-yl methacrylate)		335	Heating rate 20K/min	842
	Poly(magnesium methacrylate)		~ 763	Extrapolated value	843
	Poly(methacrylic acid)		501	Extrapolated data from plasticised samples	882
	Poly(methacrylic anhydride) see Section 4.27				
	Poly(4-methoxycarbonylphenyl methacrylate)		379		746
	Poly(3,5-dimethyladamantyl methacrylate)		469	Temperature reported as "corrected"	849, 850
	Poly(dimethylaminoethyl methacrylate)		292		746
	Poly(3,3-dimethylbutyl methacrylate)		~ 318	Vicat softening point 332K	863
	Poly(3,3-dimethyl-2-butyl methacrylate)		~ 381	Vicat softening point 396K	863
	Poly(3,5,5-trimethylhexyl methacrylate)		274		867
	Poly(methyl methacrylate)	atactic	378		1, 17, 22, 25-27, 69, 78, 79, 81, 190, 201, 263, 286, 287, 317, 318, 352-354, 400, 614, 684, 698, 720, 775, 777-779, 789, 804, 821, 824, 846, 858, 860, 862, 880, 883-895
		isotactic	311		6, 122, 720, 824, 847, 884, 886, 890, 895-901
		syndiotactic	378		122, 720, 824, 847, 890, 895, 896, 898, 900, 901
	Poly(trimethylsilyl methacrylate)	isotactic	341	Heating rate 15K/min, weak T_g for syndiotactic polymer	902
		syndiotactic	400		
	Poly[(2-nitratoethyl) methacrylate]		328		903
	Poly(octadecyl methacrylate)		173		1, 720, 904
	Poly(octyl methacrylate)		203, 253	Conflicting data	23, 695, 821, 840, 846, 858
	Poly(3-oxabutyl methacrylate)		289		846, 857
	Poly(3-oxa-5-hydroxypentyl methacrylate)		278-280	Mechanical method	880
	Poly(pentyl methacrylate)		268	Brittle point	821
	Poly(phenethyl methacrylate)		299		746
	Poly(phenyl methacrylate)		383		353, 746, 820, 847, 863, 875
	Poly(propyl methacrylate)		308	Conflicting data, 308-345K reported	22, 262, 272, 821, 847, 857, 858, 860, 862, 877, 878, 880
	Poly(sodium methacrylate)		~ 583	Extrapolated value	843
	Poly(tetradecyl methacrylate)		201-264	Conflicting data	23, 821, 840, 866
1.3.4	Poly(methacrylamides)				
	Poly(4-butoxycarbonylphenylmethacrylamide)		401	Softening point	905
	Poly(N-tert-butylmethacrylamide)		433	No experimental details	820
	Poly(4-carboxyphenylmethacrylamide)		473	Softening point	905
	Poly(4-ethoxycarbonylphenylmethacrylamide)		441	Softening point	905
	Poly(4-methoxycarbonylphenylmethacrylamide)		453	Softening point	905
1.3.5	Other α- and β-substituted Poly(acrylics) and Poly(methacrylics)				
	Poly(butyl butoxycarbonylmethacrylate)		298		906
	Poly(butyl chloroacrylate)		330	Vicat softening point	863
	Poly(sec-butyl chloroacrylate)		347	Vicat softening point	863
	Poly(butyl cyanoacrylate)		358		907
	Poly(dibutyl itaconate) see Poly(butyl butoxycarbonylmethacrylate)				
	Poly(cyclohexyl chloroacrylate)		387	Vicat softening point	863

	Polymer		T_g(K)	Remarks	References
1.3.5	Other α- and β-substituted Poly(acrylics) and Poly(methacrylics) (Cont'd.)				
	Poly(ethyl chloroacrylate)		366	Vicat softening point	832,863,908,909
		100% isotactic	308	Calculated for infinite Mn; heating rate 20K/min	
		100% syndiotactic	404	Calculated for infinite Mn; heating rate 20K/min	
	Poly(ethyl ethoxycarbonylmethacrylate)		325	Intrinsic viscosity only 0.24 dl/g	906
	Poly(ethyl ethacrylate)		300		746
	Poly(ethyl fluoromethacrylate)		316		910
	Poly(hexyl hexyloxycarbonylmethacrylate)		269	Intrinsic viscosity only 0.24 dl/g	906
	Poly(isobutyl chloroacrylate)		363		832,911
	Poly(isopropyl chloroacrylate)		363	Vicat softening point	832,863
	Poly(methyl chloroacrylate)		413	Vicat softening point	863
	Poly(methyl β-chloroacrylate)		416	No measurement details	820
	Poly(methyl fluoroacrylate)		404	No details on samples or measurement	820,912
	Poly(methyl fluoromethacrylate)		357	No experimental details	820,910
	Poly(methyl phenylacrylate)	atactic	391		913
		isotactic	397		
	Poly(propyl chloroacrylate)		344	Vicat softening point	832,863
1.4	Poly(vinyl ethers) and Poly(vinyl thioethers)				
	Poly(butoxyethylene)		218		1,832,866,914-918
	Poly(sec-butoxyethylene)		253		866,914
	Poly(tert-butoxyethylene)		361		1,918
	Poly(butylthioethylene)		253		866
	Poly(butyl vinyl ether) see Poly(butoxyethylene)				
	Poly(cyclohexyloxyethylene)		354	Softening point	918
	Poly(decyloxyethylene)		~ 183,211	Conflicting data, independent DSC data supports higher value	866,914,916,917
	Poly(ethoxyethylene)		230		1,223,521,573,832, 866,914-920
	Poly[(2-ethylhexyloxy)ethylene]		207		866,915
	Poly(ethylthioethylene)		266	Viscosity only 0.2 dl/g	866
	Poly(dodecafluorobutoxyethylene)		263-273	T_g estimated from copolymer data	457
	Poly(2,2,2-trifluoroethoxytrifluoroethylene)		308	DTA heating rate	457,921
	Poly[1,1-bis(trifluoromethoxy)difluoroethylene]		213	Poorly defined DTA endotherms	457
	Poly(1,1-difluoro-2-trifluoromethoxyethylene)		263-273	Estimated from copolymer data	457
	Poly(1,2-difluoro-1-trifluoromethoxyethylene)		263-273	Estimated from copolymer data	457
	Poly(hexafluoromethoxyethylene)		268	DTA heating rate	457
	Poly[heptafluoro-2-propoxy)ethylene]		~ 328-338		839
	Poly(hexyloxyethylene)		199		866,914-918
	Poly(isobutoxyethylene)		254		1,223,573,832,866, 914,916-918,920, 922
	Poly(isopropenyl methyl ether) see Poly(2-methoxypropylene)				
	Poly(isopropoxyethylene)		270		832,866,914,918
	Poly(methoxyethylene)		242		1,223,805,866, 914-918, 920
	Poly(2-methoxypropylene)		340		866
	Poly(2,2-dimethylbutoxyethylene)		282	Mechanical method	918
	Poly(methylthioethylene)		272		866
	Poly(neopentyloxyethylene)		~ 424	Softening point	918
	Poly(octyloxyethylene)		194		866,914-917
	Poly(pentyloxyethylene)		207		866,915
	Poly(propoxyethylene)		224		832,915
	Poly(vinyl methyl ether) see Poly(methoxyethylene)				

	Polymer	T_g(K)	Remarks	References
1.5	Poly(vinyl alcohol) and Poly(vinyl ketones)			
	Poly(1-acetyl-1-fluoroethylene)	415		923
	Poly(benzoylethylene)	314,347	Conflicting data	924,925
	Poly(4-bromo-3-methoxybenzoylethylene)	317	Mechanical method	924
	Poly(4-tert-butylbenzoylethylene)	377		925
	Poly(4-chlorobenzoylethylene)	310,362	Conflicting data.	924,925
	Poly(4-ethylbenzoylethylene)	325		924,925
	Poly(4-isopropylbenzoylethylene)	336		925
	Poly(4-methoxybenzoylethylene)	319	Mechanical method	924
	Poly(3,4-dimethylbenzoylethylene)	315	Mechanical method	924
	Poly(phenyl vinyl ketone) see Poly(benzoylethylene)			
	Poly(4-propylbenzoylethylene)	317		925
	Poly(p-toluoylethylene)	344		924,925
	Poly(vinyl alcohol) [Poly(hydroxyethylene)]	358	Dynamic method	1,191,202,216,230,261,573,926,927
1.6	Poly(vinyl halides) and Poly(vinyl nitriles)			
	Poly(1-acetoxy-1-cyanoethylene)	420	Heating rate 8K/min	255
	Poly(acrylonitrile) [poly(cyanoethylene)]	370		1,7,26,80,191,202,393,400,521,525,576,752,772,779,787,928-941
	Poly(1,1-dichloroethylene)	255		1,6,62,80,216,521,524,648,942-944
	Poly(chlorotrifluoroethylene)	~ 325	By 'static' methods	66,80,191,261,349,355,396,401,521,647,893,945-961
		373	By mechanical methods, even at low frequencies	
	Poly(1,1-dichloro-2-fluoroethylene)	~ 320	$[\eta]$ only 0.035 dl/g	962
	Poly(1,2-dichloro-1,2-difluoroethylene)	350	Heating rate 5-20K/min, high pressure, radiation synthesis	97
	Poly(1,1-difluoroethylene)	~ 233		401,963-970
	Poly(1,2-difluoroethylene)	371	DTA heating rate	114,457,971
	Poly(tetrafluoroethylene) [poly(difluoromethylene)]	160,400	Much data, some conflicting	1,6,66,190,191,253,261,355,356,396,521,522,641,651,659,891,893,914,921,952,972-1005
	Poly(trifluoroethylene)	304	Quoted value, DTA?	457
	Poly[(pentafluoroethyl)ethylene]	314	Heating rate 5-20 K/min, high pressure, radiation synthesis	97
	Poly(tetradecafluoropentylethylene)	503?	Heating rate 5-20K/min, high pressure, radiation synthesis, value uncertain	97
	Poly(hexafluoropropylene)	425	Heating rate 5-20K/min	97,984,1006
	Poly(2,3,3,3-tetrafluoropropylene)	315	Heating rate 5-20K/min, high pressure, radiation synthesis	97
	Poly(3,3,3-trifluoropropylene)	300		97,914,1007,1008
	Poly[(heptafluoropropyl)ethylene]	331	Heating rate 5-20K/min, high pressure, radiation synthesis	97
	Poly(2-iodoethylethylene)	343	Dynamic method	1009
	Poly(9-iodononylethylene)	267	Dynamic method	1009
	Poly(3-iodopropylethylene)	~ 303	Dynamic method	1009
	Poly(methacrylonitrile)	393		1
	Poly(vinyl chloride)	354	Increasing syndiotactic content increases T_g to 371K	1,21,52,78,80,104,188,191,230,286,349,353,354,356,469,608,696,720,772,777,787,798,861,926,942,944,972,1010-1031
	Poly(vinyl fluoride)	314	Mechanical method	521,1032,1033
	Poly(vinylidene chloride) see Poly(1,1-dichloroethylene)			

	Polymer	T_g(K)	Remarks	References
1.6	Poly(vinyl halides) and Poly(vinyl nitriles) (Cont'd.)			
	Poly(vinylidene fluoride) see Poly(1,1-difluoroethylene)			
1.7	Poly(vinyl esters)			
	Poly[(2-acetoxybenzoyloxy)ethylene]	333		29,925
	Poly(4-acetoxybenzoyloxyethylene)	~ 349		29,925
	Poly(acetoxyethylene) (Poly(vinyl acetate))	305		1,9,12,19,22,62,187,216, 223,230,286,352,354,399, 400,573,593,695,775,777, 792,816,840,845,888,926, 928,932,1016,1034-1044
	Poly[(1-acetylindazol-3-ylcarbonyloxy)ethylene]	423	Heating rate 20K/min - "onset" value	1045
	Poly(4-benzoylbutyryloxyethylene)	318	DTA heating rate	1046
	Poly(benzoyloxyethylene)	344		29,354,755,820,925, 1047,1048
	Poly(3-bromobenzoyloxyethylene)	331		29,925
	Poly(4-bromobenzoyloxyethylene)	365		29,925,1047,1048
	Poly[(tert-butoxycarbonylamino)ethylene]	393	DTA heating rate	1049
	Poly(4-tert-butylbenzoyloxyethylene)	374		29,925,1050
	Poly(4-butyryloxybenzoyloxyethylene)	334		29,925
	Poly[(2-chlorobenzoyloxy)ethylene]	335		29,925,1048
	Poly(3-chlorobenzoyloxyethylene)	338		29,925,1048
	Poly(4-chlorobenzoyloxyethylene)	357		29,925,1047,1048
	Poly(cyclohexanoyloxyethylene)	349	Mechanical method, heating rate 30K/h	1043
	Poly(cyclohexylacetoxyethylene)	298	Mechanical method, heating rate 30K/h	1043
	Poly(4-cyclohexylbutyryloxyethylene)	~ 263	Mechanical method, heating rate 30K/h	1043
	Poly(cyclopentanoyloxyethylene)	309	Mechanical method, heating rate 30K/h	1043
	Poly(cyclopentylacetoxyethylene)	270	Mechanical method, heating rate 30K/h	1043
	Poly(4-ethoxybenzoyloxyethylene)	343		29,925
	Poly(4-ethylbenzoyloxyethylene)	326		29,925
	Poly[(2-ethyl-2,3,3-trimethylbutyryloxy)ethylene]	388	Mechanical method	1043
	Poly[(trifluoroacetoxy)ethylene]	~319,>348	Conflicting data	1051,1052
	Poly[(heptafluorobutyryloxy)ethylene]	300		1051
	Poly[(undecafluorocyclohexylcarbonyloxy)ethylene]	327		1051
	Poly[(nonadecafluorodecanoyloxy)ethylene]	253-255		1051
	Poly[(undecafluorohexanoyloxy)ethylene]	264	Plasticiser may be present	1051
	Poly[(pentadecafluorooctanoyloxy)ethylene]	258-263		1051
	Poly[(pentafluoropropionyloxy)ethylene]	315		1051
	Poly[(nonafluorovaleryloxy)ethylene]	288-293		1051
	Poly(formyloxyethylene)	310	~ 60% syndiotactic diads	593
		306	50% syndiotactic diads	
	Poly(isonicotinoyloxyethylene)	372	From polyvinyl alcohol	29,288,1053
	Poly(4-isopropylbenzoyloxyethylene)	342		29,925
	Poly[(2-isopropyl-2,3-dimethylbutyryloxy)ethylene]	393	Mechanical method	1043
	Poly[(2-methoxybenzoyloxy)ethylene]	338		29,925
	Poly[(3-methoxybenzoyloxy)ethylene]	~ 317		29,925
	Poly[(4-methoxybenzoyloxy)ethylene]	360		29,757,925,1047,1048
	Poly[(2-methylbenzoyloxy)ethylene]	321		29,820,925,1048
	Poly[(3-methylbenzoyloxy)ethylene]	324		29,925,1048
	Poly[(4-methylbenzoyloxy)ethylene]	343		29,925,1047,1048
	Poly[(1-methylcyclohexanoyloxy)ethylene]	359	Mechanical method, heating rate 30K/h	1043
	Poly(3,3-dimethyl-3-phenylpropionyloxyethylene)	293	Mechanical method, heating rate 30K/h	1043
	Poly[(3-trimethylsilylbenzoyloxy)ethylene]	353	DTA heating rate	1054
	Poly[(4-trimethylsilylbenzoyloxy)ethylene]	408	DTA heating rate	1054,1055

	Polymer	T_g(K)	Remarks	References
1.7	Poly(vinyl esters) (Cont'd.)			
	Poly[(2,2-dimethylvaleryloxy)ethylene]	283	Mechanical method	1043
	Poly[(2,2,3,3-tetramethylvaleryloxy)ethylene]	363	Mechanical method	1043
	Poly[(2,2,3,4-tetramethylvaleryloxy)ethylene]	323	Mechanical method	1043
	Poly[(2,2,4,4-tetramethylvaleryloxy)ethylene]	328	Mechanical method	1043
	Poly(nicotinoyloxyethylene)	360	From polyvinyl alcohol	29,1053
	Poly(nitratoethylene)	307		903
	Poly[(3-nitrobenzoyloxy)ethylene]	366		29,925
	Poly[(4-nitrobenzoyloxy)ethylene]	395		29,925
	Poly[(4-phenylbenzoyloxy)ethylene]	358		29,925
	Poly(pivaloyloxyethylene)	359	Mechanical method	1043
	Poly[(4-propionyloxybenzoyloxy)ethylene]	345		29,925
	Poly(propionyloxyethylene)	283	Mechanical method	1043
	Poly[(4-p-toluoylbutyryloxy)ethylene]	313	DTA heating rate	1046
	Poly(vinyl acetate) see Poly(acetoxyethylene)			
	Poly(vinyl formate) see Poly(formyloxyethylene)			
	Poly(vinyl-4-isopropylbenzoate) see Poly(4-isopropylbenzoyloxyethylene)			
1.8	Poly(styrenes)			
	Poly(4-acetylstyrene)	389	Mechanical method	728
	Poly(4-p-anisoylstyrene)	376	Mechanical method	728
	Poly(4-benzoylstyrene)	371	Mechanical method	728
	Poly[(2-benzyloxymethyl)styrene]	345	Mechanical method	729
	Poly[3-(4-biphenylyl)styrene]	~ 471	Softening point	730
	Poly[4-(4-biphenylyl)styrene]	593	Softening point	730
	Poly(5-bromo-2-butoxystyrene)	320	Mechanical method	731
	Poly(5-bromo-2-ethoxystyrene)	353	Mechanical method	731
	Poly(5-bromo-2-isopentyloxystyrene)	310	Mechanical method, low viscosity	731
	Poly(5-bromo-2-isopropoxystyrene)	308	Mechanical method	731
	Poly(5-bromo-2-methoxystyrene)	359	Mechanical method	731
	Poly(5-bromo-2-pentyloxystyrene)	322	Mechanical method; low viscosity	731
	Poly(5-bromo-2-propoxystyrene)	327	Mechanical method; low viscosity	731
	Poly(4-bromostyrene)	391		732-734
	Poly(2-butoxycarbonylstyrene)	339	Mechanical method	735
	Poly(4-butoxycarbonylstyrene)	349	Mechanical method	728
	Poly(4-[(2-butoxyethoxy)methyl] styrene)	< 235		736
	Poly(2-butoxymethylstyrene)	340	Mechanical method	729
	Poly(4-butoxymethylstyrene)	< 283		736
	Poly[4-(sec-butoxymethyl)styrene]	313	Dynamic method	736
	Poly(4-butoxystyrene)	~ 320	Mechanical method	736,737
	Poly(5-tert-butyl-2-methylstyrene)	360		732
	Poly(4-butylstyrene)	279		736,738,739
	Poly(4-sec-butylstyrene)	359	Softening point	739
	Poly(4-tert-butylstyrene)	403		83,739-741
	Poly(4-butyrylstyrene)	347	Mechanical method	728
	Poly(2-carboxystyrene)	450	Mechanical method	742
	Poly(4-carboxystyrene)	386	Mechanical method	728
	Poly(4-chloro-3-fluorostyrene)	395		732
	Poly(4-chloro-2-methylstyrene)	418		732
	Poly(4-chloro-3-methylstyrene)	387		732
	Poly(2-chlorostyrene)	392		732
	Poly(3-chlorostyrene)	363		732
	Poly(4-chlorostyrene)	383		83,732-734
	Poly(2,4-dichlorostyrene)	406		732,743
	Poly(2,5-dichlorostyrene)	379		44,732,744
	Poly(2,6-dichlorostyrene)	440		83,569,745
	Poly(3,4-dichlorostyrene)	401		732,744
	Poly(4-cyanostyrene)	393	Sample thought to be crosslinked	746
	Poly(4-decylstyrene)	208		738
	Poly(4-dodecylstyrene)	221		738
	Poly(2-ethoxycarbonylstyrene)	391	Mechanical method	735

	Polymer	T_g(K)	Remarks	References
1.8	Poly(styrenes) (Cont'd.)			
	Poly(4-ethoxycarbonylstyrene)	367	Mechanical method	728
	Poly[4-(2-ethoxyethoxymethyl)styrene]	273	Dynamic method	736
	Poly(2-ethoxymethylstyrene)	347	Mechanical method; viscosity low	729
	Poly(4-ethoxystyrene)	~ 359	Mechanical method	737
	Poly[4-(2-diethylaminoethoxycarbonyl)styrene hydrochloride]	347	Mechanical method	728
	Poly(4-diethylcarbamoylstyrene)	375	Mechanical method	728
	Poly[4-(1-ethylhexyloxymethyl)styrene]	250		736
	Poly(2-ethylstyrene)	376	Softening point	739
	Poly(3-ethylstyrene)	~ 303	Softening point	739
	Poly(4-ethylstyrene)	300, <351	Conflicting data	736, 738, 739
	Poly[4-(pentadecafluoroheptyl)styrene]	320	Heating rate 32K/min, T_g thermal history dependent	747
	Poly(2-fluoro-5-methylstyrene)	384	Mechanical method	748
	Poly(4-fluorostyrene)	368		732-734, 749-751
	Poly(2, 5-difluorostyrene)	374	Softening point	83
	Poly(2, 3, 4, 5, 6-pentafluorostyrene)	378	Heating rate 5-20K/min	97
	Poly(perfluorostyrene)	467	Heating rate 5-20K/min	97
	Poly(α, β, β-trifluorostyrene)	475	Heating rate 5-20K/min values up to 513K reported	83, 97, 114, 752, 753
	Poly(4-hexadecylstyrene)	278		738
	Poly(4-hexanoylstyrene)	339	Mechanical method	728
	Poly(2-hexyloxycarbonylstyrene)	318	Mechanical method	735
	Poly(4-hexyloxycarbonylstyrene)	339	Mechanical method	728
	Poly(4-hexyloxymethylstyrene)	253	Dynamic method	736
	Poly(4-hexylstyrene)	246		738
	Poly[4-(4-hydroxybutoxymethyl)styrene]	293	Dynamic method	736
	Poly[4-(2-hydroxyethoxymethyl)styrene]	319	Dynamic method	736
	Poly[4-(1-hydroxyiminoethyl)styrene]	407	Mechanical method	728
	Poly(4-[(1-hydroxyimino)-2-phenethyl] styrene)	384	Mechanical method	728
	Poly[4-(1-hydroxy-3-dimethylaminopropyl)styrene]	316	Mechanical method; viscosity low	754
	Poly[4-(1-hydroxy-1-methylbutyl)styrene]	~ 403	Softening point	754
	Poly[4-(1-hydroxy-1-methylethyl)styrene]	~ 438	Softening point	754
	Poly[4-(1-hydroxy-1-methylhexyl)styrene]	~ 364	Softening point	754
	Poly[4-(1-hydroxy-1-methylpentyl)styrene]	~ 356	Softening point	754
	Poly[4-(1-hydroxy-1-methylpropyl)styrene]	~ 459	Softening point	754
	Poly(2-hydroxymethylstyrene)	433		1
	Poly(3-hydroxymethylstyrene)	398	Dynamic method	1
	Poly(4-hydroxymethylstyrene)	413		1
	Poly[4-(1-hydroxy-3-morpholinopropyl)styrene]	323	Mechanical method; viscosity low	754
	Poly[4-(1-hydroxy-3-piperidinopropyl)styrene]	327	Mechanical method; viscosity low	754
	Poly(4-iodostyrene)	429		733, 734
	Poly(2-isobutoxycarbonylstyrene)	400	Mechanical method	735
	Poly(4-isobutoxycarbonylstyrene)	363	Mechanical method	728
	Poly(2-isopentyloxycarbonylstyrene)	341	Mechanical method	735
	Poly(2-isopentyloxymethylstyrene)	351	Mechanical method; viscosity low	729
	Poly(4-isopentyloxystyrene)	~ 330	Mechanical method	737
	Poly(2-isopropoxycarbonylstyrene)	419	Mechanical method	735
	Poly(4-isopropoxycarbonylstyrene)	368	Mechanical method	728
	Poly(2-isopropoxymethylstyrene)	361	Mechanical method, viscosity low	729
	Poly(4-isopropylstyrene)	360	Softening point	739
	Poly(2, 4-diisopropylstyrene)	~ 435	Softening point	83
	Poly(2, 5-diisopropylstyrene)	441	Softening point	83
	Poly(2-methoxycarbonylstyrene)	403	Mechanical method, viscosity low	742
	Poly(4-methoxycarbonylstyrene)	386	Mechanical method	728
	Poly(2-methoxymethylstyrene)	362	Mechanical method; viscosity low	729
	Poly(4-methoxymethylstyrene)	350	Dynamic method	736
	Poly(4-methoxy-2-methylstyrene)	~ 358	Softening point	755
	Poly(2-methoxystyrene)	~ 348	Softening point	755
	Poly(4-methoxystyrene)	~ 362	Mechanical method	737, 755-757
	Poly(2-methylaminocarbonylstyrene)	462	Mechanical method	742
	Poly(2-dimethylaminocarbonylstyrene)	463	Mechanical method; viscosity low	742
	Poly(4-dimethylaminocarbonylstyrene)	398	Mechanical method	728

	Polymer		T_g(K)	Remarks	References
1.8	Poly(styrenes) (Cont' d.)				
	Poly[2-(2-dimethylaminoethoxycarbonyl)styrene]		342	Mechanical method	735
	Poly[4-(2-dimethylaminoethoxycarbonyl)styrene]		373	Mechanical method	728
	Poly[4-(2-dimethylaminoethoxycarbonyl)styrene hydrochloride]		355	Mechanical method	728
	Poly(α-methylstyrene)		441		6,83,758-765
	Poly(2-methylstyrene)		409		63,732,739,749,755
	Poly(3-methylstyrene)		370	DTA heating rate	732,739,749,766
	Poly(4-methylstyrene)		366,374	Conflicting data	732,739,756,766,767
	Poly(2,4-dimethylstyrene)		385		122,732,739,749,768
	Poly(2,5-dimethylstyrene)		416	DTA heating rate	732
	Poly(3,4-dimethylstyrene)		384	DTA heating rate	732
	Poly(3,5-dimethylstyrene)		377		749
	Poly(2,4,5-trimethylstyrene)		~ 409	Softening point	83
	Poly(2,4,6-trimethylstyrene)		~ 435	Softening point	83
	Poly(4-morpholinocarbonylstyrene)		400	Mechanical method	728
	Poly[4-(3-morpholinopropionyl)styrene]		314	Mechanical method	754
	Poly(4-nonadecylstyrene)		305		1
	Poly(4-nonylstyrene)		220		738
	Poly(4-octadecylstyrene)		305		738
	Poly(4-octanoylstyrene)		323	Mechanical method	728
	Poly[4-(octyloxymethyl)styrene]		231	Dynamic method	736
	Poly(2-octyloxystyrene)		286		769
	Poly(4-octylstyrene)		228		738
	Poly(2-pentyloxycarbonylstyrene)		365	Mechanical method	735
	Poly(2-pentyloxymethylstyrene)		320	Mechanical method	729
	Poly(2-phenethyloxymethylstyrene)		336	Mechanical method; viscosity low	729
	Poly(2-phenoxycarbonylstyrene)		397	Mechanical method; viscosity low	742
	Poly(4-phenoxystyrene)		~ 373	Softening point	83
	Poly(4-phenylacetylstyrene)		351	Mechanical method	728
	Poly(2-phenylaminocarbonylstyrene)		464	Mechanical method; viscosity low	742
	Poly(4-phenylstyrene)		434	Extrapolated to zero rate	763,770
	Poly(4-piperidinocarbonylstyrene)		387	Mechanical method	728
	Poly[4-(3-piperidinopropionyl)styrene]		311	Mechanical method	754
	Poly(4-propionylstyrene)		375	Mechanical method	728
	Poly(2-propoxycarbonylstyrene)		381	Mechanical method	735
	Poly(4-propoxycarbonylstyrene)		365	Mechanical method	728
	Poly(2-propoxymethylstyrene)		370	Mechanical method; viscosity low	729
	Poly(4-propoxymethylstyrene)		295	Dynamic method	736
	Poly(4-propoxystyrene)		343	Mechanical method	737
	Poly(4-propoxysulfonylstyrene)	isotactic	490	DTA heating rate	771
	Poly(styrene)	isotactic and atactic	373		9,17,21,22,25,47,51,57,63,64,72,78,79,188,190,191,261,263,317,318,344,350-352,394,397,399,469,524,569,576,619,628,630,635,637,640,646,647,684,699,731-734,746,750,766,768,772-810.
	Poly(4-tetradecylstyrene)		237		738
	Poly(4-p-toluoylstyrene)		372	Mechanical method	728
	Poly(4-valerylstyrene)		343	Mechanical method	728
1.9	Others				
	Poly(benzylethylene)		333		631,634,1056
	Poly(N-carbazolylethylene)		357,423,481	Conflicting values reported	1,272,573,845
	Poly(ferrocenylethylene)		457-467	DSC heating rate	835
	Poly(indazol-2-ylethylene)		331,298	Two values for different preparations, heating rate 20K/min	1045
	Poly[dimethylamino(ethoxy)phosphinylethylene]		305		1057
	Poly[dimethylamino(phenoxy)phosphinylethylene]		300		1057
	Poly(4,4-dimethyl-5-oxazolonylethylene)		365	DTA heating rate, viscosity low	1058
	Poly(4,4-dimethyl-5-oxazolonyl-2-propylene)		380,438	Conflicting data	1058,1059

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	Polymer	T_g(K)	Remarks	References
1.9	Others (Cont' d.)			
	Poly[(2-methyl-5-pyridyl)ethylene]	403	Mechanical method	1060-1062
	Poly[(2-methyl-6-pyridyl)ethylene]	365	Heating rate 20K/min	1061
	Poly(2,4-dimethyl-1,3,5-triazinylethylene)	350		820
	Poly(1-naphthylethylene)	432?	Values range from 323-453K	83,755,763,1063
	Poly(2-naphthylethylene)	424	Extrapolated to zero heating rate	770
	Poly(phenethylethylene)	283	Crystalline sample	631,634,1056,1064
	Poly(phenethylmethylethylene)	245	Softening Point	631
	Poly(phenylacetylene) see Poly(phenylvinylene)			
	Poly(diphenylphosphinylethylene)	453		1065
	Poly(phenylvinylene)	393	Crystallline	1066
	Poly(phthalimidoethylene)	497	No experimental details	820
	Poly(2-pyridylethylene)	377		1061,1062,1067
	Poly(4-pyridylethylene)	415		1061,1062
	Poly(N-pyrrolidinylethylene)	327		573
	Poly(N-pyrrolidonylethylene)	359		1,4,907
	Poly(m-tolylmethylethylene)	313	Crystalline sample	1056
	Poly(o-tolylmethylethylene)	353	Crystalline sample	1056
	Poly(p-tolylmethylethylene)	338	Crystalline sample	1056
	Poly(vinyl carbazole) see Poly(N-carbazolylethylene)			
	Poly(vinyltrimethylgermanium)	463	Mechanical method	1068
	Poly(vinylpyridine) see Poly(pyridylethylene)			
	Poly(vinyl pyrrolidine) see Poly(N-pyrrolidinylethylene)			
2.	Main-chain Carbocyclic Polymers			
2.1	Poly(phenylenes)			
	Poly(3,3' -biphenylylenehexafluorotrimethylene)	324	Heating rate 32K/min, η_{inh} only 0.05 dl/g	563
	Poly(2-bromo-1,4-phenyleneethylene)	353	Mechanical method	564
	Poly(2-chloro-1,4-phenyleneethylene)	343	Mechanical method, heating rate 1.5K/min	300,564,565
	Poly(2,5-dichloro-1,4-phenyleneethylene)	613	Softening point, no measurement details	565
	Poly(2-cyano-1,4-phenyleneethylene)	363	Mechanical method	564
	Poly(2-ethyl-1,4-phenyleneethylene)	298	Mechanical method	564
	Poly(2-methyl-1,4-phenyleneethylene)	328	Mechanical method, heating rate 1.5K/min	564,565
	Poly(2,5-dimethyl-1,4-phenyleneethylene)	373	Mechanical method, heating rate 1.5K/min	566
	Poly(1,4-phenylenetrichloroethylene)	433	Polymer contains small amount of different structure, mechanical method; heating rate 1.5K/min	565
	Poly(1,4-phenyleneethylene)	~ 353	Mechanical method, variable data	300,564,565,567
	Poly(1,3-phenylenehexafluorotrimethylene)	303	Heating rate 32K/min, η_{inh} only 0.1 dl/g	148
	Poly(1,4-phenylene-1-phenylethylene)	428	Softening point, no experimental details	565
	Poly(2', 3',6',2''', 3''',5'''-hexaphenyl-p,p,m,p,p-quinquephenylylenedecamethylene)	453	Heating rate 20K/min, structure may contain more m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-4,4'''' -p-quinquephenylylenedecamethylene)	508	Heating rate 20K/min, structure may contain m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-p,p,m,p,p,quinquephenylylenehexamethylene)	488	Heating rate 20K/min, structure may contain more m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-4,4'''' -p-quinquephenylylenehexamethylene)	523	Heating rate 20K/min, structure may contain m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-p,p,m,p,p-quinquephenylylenetetradecamethylene)	433	Heating rate 20K/min, structure may contain more m-links	568
	Poly(2',3',6',2''',3''', 5''' -hexaphenyl-4,4'''' -p-quinquephenylylenetetradecamethylene)	458	Heating rate 20K/min, structure may contain m-links	568

	Polymer	T_g(K)	Remarks	References
2.1	Poly(phenylenes) (Cont' d).			
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-p,p,m,p,p-quinquephenylylene-tetramethylene)	453	Heating rate 20K/min, structure may contain more m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-4,4'''' -p-quinquephenylylene-tetramethylene)	478	Heating rate 20K/min, structure may contain m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-p,p,m,p,p-quinquephenylylenetrimethylene)	513	Heating rate 20K/min, structure may contain more m-links	568
	Poly(2',3',6',2''',3''',5''' -hexaphenyl-4,4'''' -quinquephenylylenetrimethylene)	563	Heating rate 20K/min, structure may contain m-links	568
2.2	Others			
	Poly(acenaphthylene)	487-618	Conflicting data reported.	31,83,566,569-571
	Poly(5-chlorononafluoro-1,3-cyclohexylenedifluoromethylene)	420	Heating rate 5-20K/min, high pressure, radiation synthesis, ring structure unproven	97
	Poly(cyclobutene) erythro di-isotactic	293	Degree of polymerization 150	572
	erythro di-syndiotactic	273	Degree of polymerization 15	
	Poly(hexafluoro-1,3-cyclobutylenedifluoromethylene)	395	Heating rate 5-20K/min, high pressure, radiation synthesis, ring structure unproven, [η] only 0.03 dl/g	97
	Poly(dodecafluoro-1,3-cycloheptylenedifluoromethylene)	471?	Heating rate 5-20K/min, high pressure, radiation synthesis, data queried in original paper, ring structure unproven.	97
	Poly(decafluoro-1,3-cyclohexylenedifluoromethylene)	374?	Heating rate 5-20K/min, ring structure unproven, crystalline, high pressure, radiation synthesis	97
	Poly(octafluoro-1,3-cyclopentylenedifluoromethylene)	390	Heating rate 5-20K/min, high pressure, radiation synthesis, ring structure unproven	97
	Poly(indenylene)	358		573
	Poly(1,4-naphthyleneethylene)	433	Mechanical method	565
3.	Main-chain Acyclic Heteroatom Polymers			
3.1	Main-chain -C-O-C-Polymers			
3.1.1	Poly(oxides)			
	Poly(acetaldehyde) see Poly(oxyethylidene)			
	Poly(3,3-bis(chloromethyl)oxacyclobutane] see Poly[oxy-2,2-bis(chloromethyl)trimethylene]			
	Poly(epichlorhydrin) see Poly[oxy(chloromethyl)ethylene]			
	Poly(ethylene oxide)s see Poly(oxyethylene)s			
	Poly(formaldehyde) see Poly(oxymethylene)			
	Poly(tetrahydrofuran) see Poly(oxytetramethylene)			
	Poly(methylene oxide) see Poly(oxymethylene)			
	Poly(2,6-dimethyl-1,4-phenylene oxide) [PPO] see Poly(oxy-2,6-dimethyl-1,4-phenylene)			
	Poly(oxacyclobutane) see Poly(oxytrimethylene)			
	Poly(oxetane)s see Poly(oxytrimethylene)s			
	Poly(oxy-2-acetoxytrimethyleneoxy-2,6-dichloro-1,4-phenyleneisopropylidene-3,5-dichloro-1,4-phenylene)	373		219
	Poly(oxy-2-acetoxytrimethyleneoxy-1,4-phenylene)	322		219
	Poly(oxy-2-acetoxytrimethyleneoxy-1,4-phenylene-1-ethyl-1,3-cyclohexylene-1,4-phenylene)	380		219
	Poly(oxy-2-acetoxytrimethyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	333		219
	Poly[oxy-2-acetoxytrimethyleneoxy-1,4-phenylenemethyl(phenyl)methylene-1,4-phenylene]	383		219
	Poly[oxy(allyloxymethyl)ethylene]	195		220
	Poly(oxy-2-benzoyloxytrimethyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	338		219
	Poly[oxy-2-benzoyloxytrimethyleneoxy-1,4-phenylenemethyl(phenyl)methylene-1,4-phenylene]	399		219
	Poly[oxy-2-(2-biphenylyl)-6-phenyl-1,4-phenylene]	484	DSC heating rate: low viscosity	221

Polymer	T_g(K)	Remarks	References
3.1.1 Poly(oxides) (Cont' d.)			
Poly[oxy(bromomethyl)ethylene]	259	Heating rate 20K/min	222
Poly(oxybutadiene)	198	Structure not given	223, 224
Poly[oxy(butoxymethyl)ethylene]	194	Heating rate 10K/min	220
Poly(oxybutylethylene)	203	Heating rate 10K/min	220
Poly(oxy-tert-butylethylene)	308		223, 225-227
Poly[oxy-2-(4-tert-butylphenyl)-6-phenyl-1, 4-phenylene]	513	DSC heating rate	221
Poly[oxy-2-(chloroacetoxy)trimethyleneoxy-1, 4-phenyleneisopropylidene-1, 4-phenylene]	338		219
Poly[oxy-2-(2-chlorobenzoyloxy)trimethyleneoxy-1, 4-phenyleneisopropylidene-1, 4-phenylene]	339		219
Poly(oxy-2, 2, 2-trichloroethylethylene)	271	No measurement details	229
Poly[oxy(chloromethyl)ethylene]	251	Heating rate 20K/min	222
Poly[oxy-2, 2-bis(chloromethyl)trimethylene]	265		1, 122, 230-236
Poly(oxydecylethylene)	232		220, 223
Poly[oxy(ethoxymethyl)ethylene]	212		220
Poly(oxy-2-ethyl-2-chloromethyltrimethylene)	~ 293	Dynamic method	237
Poly(oxyethylene)	232?	Conflicting data; values range from 158-233K	107, 223, 234, 238-244
Poly(oxyethylethylene)	203		220
Poly(oxyethylidene)	243		250, 251
Poly[oxy-1-(2, 2, 3, 3-tetrafluorocyclobutyl)ethylene]	248	Mechanical method, heating rate 2K/min	252
Poly(oxytetrafluoroethylene)	225	Low molecular weight	253, 254
Poly(oxy-2, 2, 3, 3, 4, 4-hexafluoropentamethyleneoxy-4, 4' -octafluorobiphenylylene)	314	Heating rate 32K/min	255
Poly(oxy-2, 2, 3, 3, 4, 4-hexafluoropentamethyleneoxymethylene-1, 4-phenylene-methylene)	247	Heating rate 32K/min	256
Poly(oxyoctafluorotetramethylene)	~ 208	Heating rate 10K/min	254, 257
Poly[oxy-1-(heptafluoro-2-propoxymethyl)ethylene]	~ 230	DTA heating rate	258
Poly(oxyhexylethylene)	206	Heating rate 10K/min	220
Poly[oxy(hexyloxymethyl)ethylene]	190		220
Poly(oxy-2-hydroxytrimethyleneoxy-2-chloro-1, 4-phenyleneisopropylidene-3-chloro-1, 4-phenylene)	358		259
Poly(oxy-2-hydroxytrimethyleneoxy-2, 6-dichloro-1, 4-phenyleneisopropylidene-3, 5-dichloro-1, 4-phenylene)	388		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylene)	333		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylene-1-ethyl-1, 4-cyclohexylene-1, 4-phenylene)	413		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenyleneisobutylidene-1, 4-phenylene)	368		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenyleneisopropylidene-1, 4-phenylene)	373		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylene-5-isopropyl-2-methyl-1, 2-cyclohexylene-1, 4-phenylene)	448		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylene-1-methyl-1, 4-cyclohexylene-isopropylidene-1, 4-phenylene)	408		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylenemethylene-1, 4-phenylene)	353		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylene-3, 3-dimethyl-1, 6-indanylene)	393		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylene-1, 3, 3-trimethyltrimethylene-1, 4-phenylene)	348		259
Poly(oxy-2-hydroxytrimethyleneoxy-1, 4-phenylenemethyl(phenyl)methylene-1, 4-phenylene)	383		219
Poly[oxy(methoxymethyl)ethylene]	211	Heating rate 10K/min	220
Poly(oxy-2, 6-dimethoxy-1, 4-phenylene)	440		260
Poly(oxymethylene)	191	Values range from 183-263K	1, 6, 68, 191, 230, 233, 238, 239, 261-271
Poly(oxytetramethylene)	189		237, 238, 243, 272-278
Poly(oxytrimethylene)	195		238, 272, 273, 278-281
Poly(oxymethyleneoxy-2, 2, 3, 3, 4, 4-hexafluoropentamethylene)	220	Heating rate 32K/min	284
Poly[di(oxymethylene)oxy-2, 2, 3, 3, 4, 4-hexafluoropentamethylene]	218		285
Poly(oxymethyleneoxy-2, 2, 3, 3, 4, 4, 5, 5-octafluorohexamethylene)	220	Heating rate 32K/min	284
Poly(oxymethylene-1, 3-phenylenemethyleneoxy-2, 2, 3, 3, 4, 4-hexafluoropentamethylene)	238		256

	Polymer	T_g(K)	Remarks	References
3.1.1	Poly(oxides) (Cont'd.)			
	Poly(oxymethylene-1,4-phenyleneoxy-1,4-phenylenemethyleneoxy-2,2,3,3,4,4-hexafluoropentamethylene)	270	Heating rate 32K/min; high rate effect	256
	Poly(oxy-1,1-dimethylethylene)	264		223
	Poly(oxy-1,2-dimethylethylene) trans	277		223
	Poly(oxy-1-methyltrimethylene)	223	Dynamic method	281
	Poly(oxy-2-methyltrimethylene)	218	Dynamic method	281
	Poly(oxy-2,6-dimethyl-1,4-phenylene)	482		102,114,202,262, 286-300
	Poly(oxy-2-methyl-6-phenyl-1,4-phenylene)	428		299
	Poly[oxy-2-(1-naphthyl)-6-phenyl-1,4-phenylene]	507	DSC heating rate; low viscosity	221
	Poly(oxy-3-nitro-1,3-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	423	Mechanical method	116
	Poly(oxydiphenoxymethyleneoxy-4,4' biphenylylene)	385	DSC heating rate	379
	Poly(oxydiphenoxymethyleneoxy-3,3'-dimethyl-4,4'-biphenylylene)	398	DSC heating rate	379
	Poly(oxydiphenoxymethyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	365	DSC heating rate	379
	Poly(oxy-1,3-phenylene)	~318	DTA heating rate; low viscosity	114,295
	Poly(oxy-1,4-phenylene)	358	DTA heating rate	288,305-307
	Poly[di(oxy-1,4-phenylene)carbonyl-1,4-phenylene]	433	Mechanical method	116
	Poly[tri(oxy-1,4-phenylene)carbonyl-1,4-phenylene]	423	Mechanical method	116
	Poly(oxy-1,4-phenylenecarbonyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-4-methyl-1,4-cyclohexylene-1,4-phenylene)	493	Mechanical method	116
	Poly(oxy-1,4-phenylenecarbonyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	428	Mechanical method	116
	Poly(oxy-1,4-phenylene-2,2-dicyanotrimethylene-1,4-phenylene)	420	DTA heating rate	310
	Poly[oxy-1,4-phenylene-(2-cyano)-2-phenyltrimethylene-1,4-phenylene]	416	Proposed structure; DTA heating rate	310
	Poly[oxy-1,4-phenylene-2,2-di(ethoxycarbonyl)trimethylene-1,4-phenylene]	327	DTA heating rate	310
	Poly(oxy-1,4-phenylenehexafluoro-2,2-propylidene-1,4-phenyleneoxy-1,4-phenylenecarbonyl-1,4-phenylene)	443	Mechanical method	116
	Poly(oxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxy-1,4-phenyleneazo-1,4-phenylene)	448	Mechanical method	116
	Poly(oxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxy-1,4-phenyleneterephthaloyl-1,4-phenylene)	438	Mechanical method	116
	Poly(oxy-1,4-phenylenemethylenefluoren-9-ylidenemethylene-1,4-phenylene)	411	Proposed structure; DTA heating rate	310
	Poly(oxyphenylethylene)	313		220,223,225,324
	Poly(oxy-2,6-diphenyl-1,4-phenylene)	493		56,299,305,325
	Poly[oxy-6-phenyl-2-(3'-o-terphenylyl)-1,4-phenylene]	485	DSC heating rate; low viscosity	221
	Poly[oxy-6-phenyl-2-(m-tolyl)-1,4-phenylene]	492	DSC heating rate; low viscosity	221
	Poly[oxy-6-phenyl-2-(p-tolyl)-1,4-phenylene]	491	DSC heating rate; low viscosity	221
	Poly(oxy-2-propionyloxytrimethyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	333		219
	Poly(oxypropylene)	198	Conflicting data	220,223,243,251,269, 273,276,281,326-332
	Poly(phenylene oxide)s see Poly(oxyphenylene)s			
3.1.2	Poly(carbonates)			
	Polycarbonate of Bisphenol A see Poly(oxycarbonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)			
	Poly(oxycarbonyloxy-2,6-dibromo-1,4-phenyleneisopropylidene-3,5-dibromo-1,4-phenylene)	430		333,334
	Poly(oxycarbonyloxy-2-chloro-6-methyl-1,4-phenyleneisopropylidene-3-chloro-5-methyl-1,4-phenylene)	427	Mechanical method, heating rate 1K/min	335
	Poly(oxycarbonyloxy-2-chloro-1,4-phenylenecyclohexylidene-3-chloro-1,4-phenylene)	443-452	Mechanical method, heating rate 1K/min	335
	Poly(oxycarbonyloxy-2,6-dichloro-1,4-phenylenecyclohexylidene-3,5-dichloro-1,4-phenylene)	436		334
	Poly(oxycarbonyloxy-2-chloro-1,4-phenyleneisopropylidene-3-chloro-1,4-phenylene)	420	Mechanical method	334,335
	Poly(oxycarbonyloxy-2,6-dichloro-1,4-phenyleneisopropylidene-3,5-dichloro-1,4-phenylene)	453,493,504	Conflicting data	334,336,337
	Poly(oxycarbonyloxy-2-cyclohexyl-1,4-phenyleneisopropylidene-1,4-phenylene)	405		338

	Polymer	T_g(K)	Remarks	References
3.1.2	Poly(carbonates) (Cont'd.)			
	Poly(oxycarbonyloxy-2,2,3,3,4,4,5,5-octafluorohexamethylene)	232	DTA heating rate	339
	Poly(oxycarbonyloxy-2-isopropyl-1,4-phenyleneisopropylidene-1,4-phenylene)	385	No experimental details	338
	Poly(oxycarbonyloxy-2-methoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	418	No experimental details	338
	Poly[oxycarbonyloxy-1,3-(2,2,4,4-tetramethylcyclobutylene)]	~500,<433,418	Conflicting data	340-342
	Poly(oxycarbonyloxyhexamethylene)	230	Low molecular weight sample	339
	Poly(oxycarbonyloxy-2-methyl-1,4-phenylenecyclohexylidene-3-methyl-1,4-phenylene)	408	Mechanical method	335,343
	Poly(oxycarbonyloxy-2-methyl-1,4-phenyleneisopropylidene-3-methyl-1,4-phenylene)	368,373,418 363-383	Conflicting data	334-336,343
	Poly(oxycarbonyloxy-2-methyl-1,4-phenyleneisopropylidene-1,4-phenylene)	413		338
	Poly(oxycarbonyloxy-2-methyl-1,4-phenylenemethylene-3-methyl-1,4-phenylene)	324	Mechanical method	335
	Poly[oxycarbonyloxy-4,6-dimethyl-1,2-phenylenemethylene-3,5-dimethyl-1,2-phenylene]	410	No experimental details	338
	Poly(oxycarbonyloxy-3-methyl-1,4-phenylenebenzylidene-2-methyl-1,4-phenylene)	455	Mechanical method	335
	Poly(oxycarbonyloxy-1,4-phenylenebenzylidene-1,4-phenylene)	394		335,338
	Poly(oxycarbonyloxy-1,4-phenylene-1,1-butylidene-1,4-phenylene)	396		344
	Poly(oxycarbonyloxy-1,4-phenylene-2,2-butylidene-1,4-phenylene)	407		335,344
	Poly(oxycarbonyloxy-1,4-phenylene-1,3-dichloro-1,1,3,3-tetrafluoro-2,2-propylidene-1,4-phenylene)	456	DTA heating rate	337
	Poly[oxycarbonyloxy-1,4-phenylene(cyano)phenylmethylene-1,4-phenylene]	411		345
	Poly(oxycarbonyloxy-1,4-phenylenecyclohexylidene-1,4-phenylene)	448		334,335,344
	Poly(oxycarbonyloxy-1,4-phenylenecyclopentylidene-1,4-phenylene)	440		334,346
	Poly(oxycarbonyloxy-1,4-phenyleneethylidene-1,4-phenylene)	403		344
	Poly(oxycarbonyloxy-1,4-phenylenefluoren-9-ylidene-1,4-phenylene)	653	Heating rate 10K/min	347
	Poly(oxycarbonyloxy-1,3-phenylenehexafluorotrimethylene-1,3-phenylene)	319		148
	Poly(oxycarbonyloxy-1,4-phenylenehexafluoro-2,2-propylidene-1,4-phenylene)	449	DTA heating rate	337
	Poly(oxycarbonyloxy-1,4-phenylene-4,4-heptylidene-1,4-phenylene)	421		334
	Poly(oxycarbonyloxy-1,4-phenyleneisobutylidene-1,4-phenylene)	422		344
	Poly(oxycarbonyloxy-1,4-phenyleneisopropylidene-1,3-phenyleneisopropylidene-1,4-phenylene)	393	No experimental details	338
	Poly(oxycarbonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	418		78,102 131,145,230,233,262,263,287,317-319,321,335-337,344,348-378
	Poly[oxycarbonyloxy-1,4-phenylenedi(isopropylidene-1,4-phenylene)]	435	No experimental details	338
	Poly(oxycarbonyloxy-1,4-phenylenemethylene-1,4-phenylene)	420	No experimental details	338,367
	Poly[oxycarbonyloxy-1,4-phenylene(methyl)phenylmethylene-1,4-phenylene]	449		334,336
	Poly(oxycarbonyloxy-1,4-phenylene-2,2-pentylidene-1,4-phenylene)	410		334
	Poly(oxycarbonyloxy-1,4-phenylenediphenylmethylene-1,4-phenylene)	394		334
	Poly(oxyethyleneoxy-1,4-phenylenecarbonyloxycarbonyl-1,4,-phenylene)	318		247
	Poly[di(oxyethylene)oxy-1,4-phenylenecarbonyloxycarbonyl-1,4-phenylene]	314		247
	Poly(oxymethyleneoxy-1,4-phenylenecarbonyloxycarbonyl-1,4-phenylene)	357		247
	Poly[di(oxymethylene)oxy-1,4-phenylenecarbonyloxycarbonyl-1,4-phenylene]	325	Amorphous	247
		335	Crystalline	247
	Poly(oxypentamethyleneoxy-1,4-phenylenecarbonyloxycarbonyl-1,4-phenylene)	326		247
	Poly(oxytetramethyleneoxy-1,4-phenylenecarbonyloxycarbonyl-1,4-phenylene)	348		247
	Poly(oxytrimethyleneoxy-1,3-phenylenecarbonyloxycarbonyl-1,3-phenylene)	326		247
	Poly(oxytrimethyleneoxy-1,4-phenylenecarbonyloxycarbonyl-1,4-phenylene)	368		247
	Poly(oxy-1,3-phenylenecarbonyloxycarbonyl-1,3-phenyleneoxypentamethylene)	334		247
	Poly(oxy-1,3-phenylenecarbonyloxycarbonyl-1,3-phenyleneoxytetramethylene)	< 293		
3.1.3	Poly(esters)			
	Poly(bisphenol A terephthalate) see Poly(oxyterephthaloyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)			
	Poly(ethylene adipate) see Poly(oxyethyleneoxyadipoyl)			
	Poly(ethylene terephthalate) see Poly(oxyethyleneoxyterephthaloyl)			
	Poly(1,4,7-trioxa-3,3,5,5-tetrafluoroheptamethylenecarbonyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylenecarbonyl)	303	Heating rate 32K/min	218

	Polymer	T_g(K)	Remarks	References
3.1.3	Poly(esters) (Cont' d.)			
	Poly(1,4,7-trioxa-3,3,5,5-tetrafluoroheptamethyleneisophthaloyl)	301	Heating rate 32K/min; η_{inh} 0.23 only	218
	Poly(1,4,7-trioxa-3,3,5,5-tetrafluoroheptamethylene-5-pentyloxyisophthaloyl)	287	Heating rate 32K/min; [η] only 0.24 dl/g	218
	Poly(oxyadipoyloxy-2,6-dichloro-1,4-phenyleneisopropylidene-3,5-dichloro-1,4-phenylene)	383	No measurement details	380
	Poly(oxyadipoyloxy-3,3',5,5'-tetramethyl-4,4'-biphenylylene)	381	Heating rate 8K/min	371
	Poly(oxyadipoyloxydecamethylene)	217		96,381
	Poly(oxyadipoyloxy-2,6-dimethyl-1,4-phenyleneisopropylidene-3,5-dimethyl-1,4-phenylene)	366	Heating rate 8K/min	371
	Poly(oxyadipoyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	341		382
	Poly(oxyadipoyloxy-2,6-diphenyl-1,4-phenylenemethylene-3,5-diphenyl-1,4-phenylene)	388	Heating rate 8K/min	305,371
	Poly(oxy-2-butenyleneoxysebacoyl) cis	232		383
	trans	233		
	Poly(oxy-5-butyl-1,3-phenyleneoxyisophthaloyl)	359		384
	Poly(oxydibutyltinoxyadipoyl)	383	Heating rate 20K/min	385
	Poly(oxydibutyltinoxyfumaroyl)	459	Heating rate 20K/min	385
	Poly(oxydibutyltinoxyterephthaloyl)	588	Heating rate 20K/min	385
	Poly(oxy-2-butynyleneoxysebacoyl)	246		383,429
	Poly(oxycarbonyl-3,3'-biphenylylenecarbonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	460	Heating rate 8K/min	386
	Poly(oxycarbonyl-1,4-cyclohexylenecarbonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene) trans	423	Heating rate 20K/min	42
	Poly(oxycarbonyl-2,6-naphthylenecarbonyloxydecamethylene)	287	No measurement details	387
	Poly(oxyethyleneoxyadipoyl)	210	Values range from 163-233K	1,96,243,354,381,388-390
	Poly[di(oxyethylene)oxyadipoyl]	227		96
	Poly[di(oxyethylene)oxyazelaoyl]	205		96
	Poly(oxyethyleneoxycarbonyl-1,4-cyclohexylenecarbonyl) trans	291	Heating rate 20K/min	42
	Poly(oxyethyleneoxycarbonyl-2,2'-dimethyl-4,4'-biphenylylenecarbonyl)	346		391
	Poly(oxyethyleneoxycarbonyl-1,1,3-trimethylindan-3,5-ylene-1,4-phenylenecarbonyl)	427	DTA heating rate	392
	Poly(oxyethyleneoxycarbonyl-1,4-naphthylenecarbonyl)	337		393
	Poly(oxyethyleneoxycarbonyl-1,5-naphthylenecarbonyl)	344	Amorphous	393
		351	Crystalline	
	Poly(oxyethyleneoxycarbonyl-2,6-naphthylenecarbonyl)	386		387,393
	Poly(oxyethyleneoxycarbonyl-2,7-naphthylenecarbonyl)	392		393
	Poly(oxyethyleneoxycarbonyl-1,4-phenylene-sec-butylidene-1,4-phenylenecarbonyl)	~380		165
	Poly[di(oxyethylene)oxydodecanedioyl]	202		96
	Poly[di(oxyethylene)oxyglutaryl]	226		96
	Poly[di(oxyethylene)oxyheptylmalonyl]	215		96
	Poly(oxyethyleneoxyisophthaloyl)	324		393
	Poly[di(oxyethylene)oxymalonyl]	244		96
	Poly[di(oxyethylene)oxymethylmalonyl)]	244		96
	Poly[di(oxyethylene)oxynonylmalonyl]	214		96
	Poly[di(oxyethylene)oxyoctadecanedioyl]	205		96
	Poly[di(oxyethylene)oxyoxalyl]	265		96
	Poly[di(oxyethylene)oxypentylmalonyl]	226		96
	Poly[di(oxyethylene)oxypimeloyl]	213		96
	Poly[di(oxyethylene)oxypropylmalonyl]	235		96
	Poly[di(oxyethylene)oxysebacoyl]	199		96
	Poly[di(oxyethylene)oxysuberoyl]	212		96
	Poly[di(oxyethylene)oxysuccinyl]	244		96
	Poly(oxyethyleneoxyterephthaloyl)	342		1,42,61,78,94,183,202,233,261,262,272,319,344,349,352-354,360,362,371,381,388,389,393-418
	Poly(oxycarbonyl-1,3-phenyleneoxy-1,3-phenylenecarbonyloxy-2,2,3,3,4,4-hexafluoropentamethylene)	293		148
	Poly(oxy-5-ethyl-1,3-phenyleneoxyisophthaloyl)	395		384

	Polymer	T_g(K)	Remarks	References
3.1.3	Poly(esters) (Cont'd.)			
	Poly[oxy-5-(pentadecafluoroheptyl)isophthaloyloxy-2,2,3,3,4,4-hexafluoropentamethylene]	300	Heating rate 32K/min: η_{inh} only 0.10 dl/g	386
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxyadipoyl)	216		419-423
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxycarbonyl-3,3'-biphenylylenecarbonyl)	318		148
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxycarbonyl-1,3-phenylenedecafluoropentamethylene-1,3-phenylenecarbonyl)	301	Heating rate 32K/min: η_{inh} low	148
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxycarbonyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylenecarbonyl)	290		148
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxy-3,6-dithiaoctanedioyl)	~ 233	Brittle point	422
	Poly(oxy-2,2,3,3,4,4,5,5-octafluorohexamethyleneoxy-3,6-dithiaoctanedioyl)	~ 235	Brittle point	422
	Poly(oxy-3-heptafluoropropylglutaryloxy-2,2,3,3,4,4-hexafluoropentamethylene)	243-248	Brittle point	422
	Poly(oxy-3-heptafluoropropylglutaryloxy-2,2,3,3,4,4,5,5-octafluorohexamethylene)	~ 248	Brittle point	422
	Poly(oxyglutaryloxy-2,2,3,3,4,4-hexafluoropentamethylene)	218-223	Brittle point	422
	Poly(oxyglutaryloxy-2,2,3,3,4,4,5,5-octafluorohexamethylene)	218-223	Brittle point	422
	Poly(oxy-5-hexyl-1,3-phenyleneoxyisophthaloyl)	335		384
	Poly(oxyisophthaloyloxy-4,4'-biphenylylene)	437,583	Conflicting data	313,424
	Poly(oxyisophthaloyloxy-2,2,3,3,4,4-hexafluoropentamethylene)	298	Heating rate 32K/min: η_{inh} 0.14 dl/g only	386,425
	Poly(oxyisophthaloyloxy-2-methyl-1,4-phenyleneisopropylidene-3-methyl-1,4-phenylene)	438	Dynamic method	366
	Poly(oxyisophthaloyloxy-2,6-dimethyl-1,4-phenyleneisopropylidene-3,5-dimethyl-1,4-phenylene)	498	Heating rate 8K/min	371
	Poly(oxyisophthaloyloxy-2-methyl-1,4-phenylenemethylene-3-methyl-1,4-phenylene)	418	Mechanical method	369
	Poly(oxyisophthaloyloxy-2,6-dimethyl-1,4-phenylenemethylene-3,5-dimethyl-1,4-phenylene)	461	Mechanical method	369
	Poly(oxyisophthaloyloxy-1,4-phenylenebenzylidene-1,4-phenylene)	433		426
	Poly(oxyisophthaloyloxy-1,4-phenylenecyclohexylidene-1,4-phenylene)	400		145
	Poly(oxyisophthaloyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	462	Heating rate 8K/min	145,369,371,427
	Poly(oxyisophthaloyloxy-1,4-phenylenemethylene-1,4-phenylene)	423	Heating rate 20K/min	313
	Poly(oxy-3,3',5,5'-tetramethyl-4,4'-biphenylyleneoxysebacoyl)	330	Heating rate 8K/min	371
	Poly(oxy-2,2,4,4,-tetramethyl-1,3-cyclobutyleneoxycarbonyl-trans-1,4-cyclohexylenecarbonyl)	442	Heating rate 20K/min	42
	Poly(oxy-2,2,4,4-tetramethyl-1,3-cyclobutyleneoxyterephthaloyl) 60-68% trans	457	Heating rate 20K/min	42,319,428
	Poly(oxymethylene-1,4-cyclohexylenemethyleneoxycarbonyl-trans-1,4-cyclohexylenecarbonyl)	325	Heating rate 20K/min	42
	Poly(oxypentamethyleneoxyadipoyl)	204		96
	Poly[di(oxy-1,4-phenylene)oxyisophthaloyl]	446	Heating rate 20K/min	313
	Poly[di(oxy-1,4-phenylene)oxy-5-pentyloxyisophthaloyl]	399	Heating rate 20K/min	313
	Poly(oxytetramethyleneoxyadipoyl)	155	Transition at 194-206K, 1st order (ref. 243), rate 10K/min.	80,96,243
	Poly(oxytrimethyleneoxyadipoyl)	214		96
	Poly(oxytetramethyleneoxycarbonyl-1,4-cyclohexylenecarbonyl)	263	Heating rate 20K/min	42
	Poly(oxytrimethyleneoxycarbonyl-1,4-cyclohexylenecarbonyl) trans	267	Heating rate 20K/min	42
	Poly(oxyhexamethyleneoxycarbonyl-2,6-naphthylenecarbonyl)	317	No measurement details	387
	Poly(oxypentamethyleneoxycarbonyl-2,6-naphthylenecarbonyl)	311	No measurement details	387
	Poly(oxytetramethyleneoxycarbonyl-2,6-naphthylenecarbonyl)	349	No measurement details	387
	Poly(oxytrimethyleneoxycarbonyl-2,6-naphthylenecarbonyl)	346	No measurement details	387
	Poly(oxytetramethyleneoxysebacoyl)	216	T_g decreased as intrinsic viscosity increased	1,383,429
	Poly(oxypentamethyleneoxyterephthaloyl)	283	DTA heating rate	411
	Poly(oxytetramethyleneoxyterephthaloyl)	290,353	Conflicting data	6,42,403,411
	Poly(oxytrimethyleneoxyterephthaloyl)	368,308	Conflicting data	42,183,403,411
	Poly(oxy-2,6-dimethyl-1,4-phenyleneisopropylidene-3,5-dimethyl-1,4-phenyleneoxysebacoyl)	318	Heating rate 8K/min	371
	Poly(oxy-5-methyl-1,3-phenyleneoxyisophthaloyl)	426		384
	Poly(oxy-2,5-dimethylterephthaloyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	457	Mechanical method	366

	Polymer	T_g(K)	Remarks	References
3.1.3	Poly(esters) (Cont' d.)			
	Poly(oxyneopentyleneoxycarbonyl-1,4-cyclohexylenecarbonyl) trans	303	Heating rate 20K/min	42
	Poly(oxyneopentyleneoxyterephthaloyl)	341	Heating rate 20K/min	42
	Poly(oxy-5-nonyl-1,3-phenyleneoxy-2-fluoroisophthaloyl)	307		432
	Poly(oxy-5-nonyl-1,3-phenyleneoxy-5-fluoroisophthaloyl)	293		255
	Poly(oxy-5-nonyl-1,3-phenyleneoxyisophthaloyl)	304		384
	Poly(oxy-5-octyl-1,3-phenyleneoxyisophthaloyl)	314		384
	Poly(oxy-5-pentyloxyisophthaloyloxy-4,4'-biphenylene)	411	Heating rate 20K/min	313
	Poly(oxy-2-pentyloxyisophthaloyloxy-2,2,3,3,4,4-hexafluoropentamethylene)	290	DTA heating rate; η_{inh} only 0.12 dl/g	425
	Poly(oxy-4-pentyloxyisophthaloyloxy-2,2,3,3,4,4-hexafluoropentamethylene)	282	DTA heating rate; η_{inh} only 0.25 dl/g	425
	Poly(oxy-5-pentyloxyisophthaloyloxy-2,2,3,3,4,4-hexafluoropentamethylene)	243	DTA heating rate	425
	Poly(oxy-5-pentyloxyisophthaloyloxy-1,4-phenylenemethylene-1,4-phenylene)	383	Heating rate 20K/min; η_{inh} only 0.13	313
	Poly(oxy-3,3',5,5'-tetraphenyl-4,4'-biphenylyleneoxysebacoyl)	371	Heating rate 8K/min.	371
	Poly(oxy-1,4-phenylenefluoren-9-ylidene-1,4-phenyleneoxysebacoyl)	424	Heating rate 10K/min	347
	Poly(oxy-1,3-phenylenehexafluorotrimethylene-1,3-phenyleneoxycarbonyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylenecarbonyl)	345		148
	Poly(oxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxycarbonyl-1,4-phenylene-sec-butylidene-1,4-phenylenecarbonyl)	~ 480		165
	Poly(oxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxycarbonyl-1,3-phenylene-hexafluorotrimethylene-1,3-phenylenecarbonyl)	389		433
	Poly(oxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxysebacoyl)	280	Heating rate 8K/min	363,371,409
	Poly[oxy-1,3-phenyleneoxy-5-(10H-eicosafluorodecyl)isophthaloyl]	356		432
	Poly[oxy-1,3-phenyleneoxy-5-(pentadecafluoroheptyl)isophthaloyl]	374		432
	Poly(oxy-1,3-phenyleneoxy-2-fluoroisophthaloyl)	393	Heating rate 32K/min	255
	Poly[oxy-1,3-phenyleneoxy-5-(heptafluoropropyl)isophthaloyl]	394	Sample of low η_{inh}	434
	Poly(oxy-1,3-phenyleneoxyisophthaloyl)	411	Values range from 411-463K	313,384,427, 435-437
	Poly(oxy-1,3-phenyleneoxy-5-pentyloxyisophthaloyl)	369	Heating rate 20K/min; η_{inh} only 0.13	313
	Poly(oxy-2,6-diphenyl-1,4-phenylenemethylene-3,5-diphenyl-1,4-phenylene-oxysebacoyl)	365	Heating rate 8K/min	371
	Poly(oxypimeloyloxy-3,3',5,5'-tetramethyl-4,4'-biphenylylene)	369	Heating rate 8K/min	371
	Poly(oxypimeloyloxy-2,6-dimethyl-1,4-phenyleneisopropylidene-3,5-dimethyl-1,4-phenylene)	357	Heating rate 8K/min	371
	Poly(oxypimeloyloxy-2,6-diphenyl-1,4-phenylenemethylene-3,5-diphenyl-1,4-phenylene)	384	Heating rate 8K/min	371
	Poly(oxypropyleneoxycarbonyl-2,6-naphthylenecarbonyl)	361	No measurement details	387
	Poly(oxypropyleneoxyterephthaloyl)	341		389
	Poly(oxy-5-propyl-1,3-phenyleneoxyisophthaloyl)	394		384
	Poly(oxyterephthaloyloxy-2-butyl-1,4-phenyleneisopropylidene-3-butyl-1,4-phenylene)	433		439
	Poly(oxyterephthaloyloxy-2-sec-butyl-1,4-phenyleneisopropylidene-3-sec-butyl-1,4-phenylene)	373	Mechanical method	439
	Poly(oxyterephthaloyloxy-2-chloro-1,4-phenyleneisopropylidene-3-chloro-1,4-phenylene)	463	Mechanical method	439
	Poly(oxyterephthaloyloxy-2-isopropyl-1,4-phenyleneisopropylidene-3-isopropyl-1,4-phenylene)	403		439
	Poly(oxyterephthaloyloxydecamethylene)	298,268	Conflicting data	6,403,411
	Poly(oxyterephthaloyloxyheptamethylene)	276	DTA heating rate	411
	Poly(oxyterephthaloyloxyhexamethylene)	318,264	Conflicting data	6,403,411
	Poly(oxyterephthaloyloxynonamethylene)	308,270	Conflicting data	6,403,411
	Poly(oxyterephthaloyloxyoctamethylene)	318	Dynamic method	403
	Poly(oxyterephthaloyloxypentamethylene)	318	Dynamic method	6,403
	Poly(oxyterephthaloyloxymethylene-1,4-cyclohexylenemethylene) 70% trans	358	Heating rate 20K/min	42,440
	Poly(oxyterephthaloyloxy-2-methyl-1,4-phenyleneisopropylidene-3-methyl-1,4-phenylene)	~ 428	Dilatometric method	366,439,441
		461	Dynamic method	
	Poly(oxyterephthaloyloxy-2,6-dimethyl-1,4-phenyleneisopropylidene-3,5-dimethyl-1,4-phenylene)	498	Heating rate 8K/min	371
	Poly(oxyterephthaloyloxy-1,4-phenylene-9,9-anthronylidene-1,4-phenylene)	570	Heating rate 10K/min	347
	Poly(oxyterephthaloyloxy-1,4-phenylenebenzylidene-1,4-phenylene)	473		426

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	Polymer	T_g(K)	Remarks	References
3.1.3	Poly(esters) (Cont' d.)			
	Poly(oxyterephthaloyloxy-1,4-phenylenecyclohexylmethylene-1,4-phenylene)	543	No measurement details	442
	Poly(oxyterephthaloyloxy-1,4-phenylenefluoren-9-ylidene-1,4-phenylene)	654	Heating rate 10K/min	347
	Poly(oxyterephthaloyloxy-1,4-phenylenehexafluoroisopropylidene-1,4-phenylene)	534	Softening point	443
	Poly(oxyterephthaloyloxy-1,4-phenylene-1,1-indanylidene-1,4-phenylene)	608	Heating rate 10K/min	347
	Poly(oxyterephthaloyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	478	DTA heating rate	363,369,371,382, 427,439,441,443
	Poly(oxy-5-tridecyl-1,3-phenyleneoxyisophthaloyl)	291		384
	Poly(oxy-5-undecyl-1,3-phenyleneoxyisophthaloyl)	295		384
	Poly(resorcinol isophthalate) see Poly(oxy-1,3-phenyleneoxyisophthaloyl)			
3.1.4	Poly(anhydrides)			
	Poly(oxycarbonyl-1,4-phenylenehexafluorotrimethylene-1,4-phenylenecarbonyl)	371		433
	Poly(oxycarbonyl-1,4-phenyleneisopropylidene-1,4-phenylenecarbonyl)	333		247
	Poly(oxycarbonyl-1,4-phenylenemethylene-1,4-phenylenecarbonyl)	395		247
	Poly(oxycarbonyl-1,4-phenylenepentamethylene-1,4-phenylenecarbonyl)	312	Amorphous	247
		319	Crystalline	
	Poly(oxycarbonyl-1,4-phenylenetetramethylene-1,4-phenylenecarbonyl)	319		247
	Poly(oxycarbonyl-1,4-phenylenethiotetramethylenethio-1,4-phenylenecarbonyl)	335		247
	Poly(oxyisophthaloyl)	403	Dynamic mechanical method	398,444
3.1.5	Poly(urethanes)			
	Poly(oxy-2-butenyleneoxycarbonyliminohexamethyleneiminocarbonyl) cis	234		383
	trans	229		
	Poly(oxy-2-butynyleneoxycarbonyliminohexamethyleneiminocarbonyl)	228		429
	Poly(oxycarbonyliminodecamethyleneiminocarbonyloxyhexadecamethylene)	307	Heating rate 1K/min	445
	Poly(oxycarbonyliminohexamethyleneiminocarbonyloxydodecamethylene)	309	Heating rate 1K/min	445
	Poly(oxycarbonyliminohexamethyleneiminocarbonyloxyhexadecamethylene)	312	Heating rate 1K/min	445
	Poly(oxycarbonyliminomethylene-1,4-phenylenemethyleneiminocarbonyloxy-decamethylene)	322	Heating rate 1K/min	445
	Poly(oxycarbonyliminomethylene-1,4-phenylenemethyleneiminocarbonyloxy-dodecamethylene)	318	Heating rate 1K/min	445
	Poly(oxycarbonyliminomethylene-1,4-phenylenemethyleneiminocarbonyloxy-hexadecamethylene)	320	Heating rate 1K/min	445
	Poly(oxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyloxydecamethylene)	291	Heating rate 10K/min	446
	Poly(oxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyloxynonamethylene)	335	Heating rate 10K/min	446
	Poly(oxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyloxyoctamethylene)	337	Heating rate 10K/min	446
	Poly(oxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl-oxyhexadecamethylene)	313	Heating rate 1K/min	445
	Poly(oxyethyleneoxycarbonyliminodecamethyleneiminocarbonyl)	334		447
	Poly(oxyethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	329	Heating rate 10K/min	446
	Poly(oxyethyleneoxycarbonyliminononamethyleneiminocarbonyl)	317		447
	Poly(oxyethyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	326	Heating rate 10K/min	446,448
	Poly(oxyethyleneoxycarbonylimino-1,4-phenyleneethylene-1,4-phenyleneimino-carbonyl)	390		447
	Poly(oxyethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenylene-iminocarbonyl)	412,366	Conflicting data	446,447
	Poly(oxyethyleneoxycarbonylimino-1,4-phenylenetetramethylene-1,4-phenylene-iminocarbonyl)	379		447
	Poly(oxyethyleneoxycarbonylimino-1,4-phenylenetrimethylene-1,4-phenylene-iminocarbonyl)	347		447
	Poly(oxy-2,2-diethyltrimethyleneoxycarbonylimino-4-methyl-1,3-phenylene-iminocarbonyl)	213		448
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxycarbonylimino-2,2,3,3-4,4,5,5-octafluorohexamethyleneiminocarbonyl)	298	DTA heating rate	449
	Poly(oxy-2,2,3,3,4,4,5,5-octafluorohexamethyleneoxycarbonylimino-2,2,3,3-4,4,5,5-octafluorohexamethyleneiminocarbonyl)	293	DTA heating rate	449
	Poly(oxy-2,2,3,3-tetrafluorotetramethyleneoxycarbonylimino-2,2,3,3,4,4,5,5-octafluorohexamethyleneiminocarbonyl)	311	DTA heating rate	450

	Polymer	T_g(K)	Remarks	References
3.1.5	Poly(urethanes) (Cont'd.)			
	Poly(oxy-2,2,3,3,4,4-hexafluoropentamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	289	DTA heating rate	449
	Poly(oxy-2,2,3,3,4,4,5,5-octafluorohexamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	271	DTA heating rate	451,452
	Poly(oxy-2,2,3,3-tetrafluorotetramethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	282	DTA heating rate	450
	Poly(oxymethylene-5-tert-butyl-1,3-phenylenemethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	387	DTA heating rate	453
	Poly(oxyhexamethyleneoxycarbonylimino-2,2,3,3,4,4,5,5-octafluorohexamethyleneiminocarbonyl)	278	DTA heating rate	451,452
	Poly(oxypentamethyleneoxycarbonylimino-2,2,3,3,4,4,5,5-octafluorohexamethyleneiminocarbonyl)	306	DTA heating rate	449
	Poly(oxytetramethyleneoxycarbonylimino-2,2,3,3,4,4,5,5-octafluorohexamethyleneiminocarbonyl)	306	DTA heating rate	450
	Poly(oxydecamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	328	Heating rate 10K/min	446
	Poly(oxydodecamethyleneoxycarbonyliminodecamethyleneiminocarbonyl)	307	Heating rate 1K/min	445
	Poly(oxyheptamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	328	Heating rate 10K/min	446
	Poly(oxyhexamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	332	Heating rate 10K/min	446
	Poly(oxynonamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	331	Heating rate 10K/min	446
	Poly(oxyoctamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	331	Heating rate 10K/min	446
	Poly(oxypentamethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	331,281	Conflicting data	446,449
	Poly(oxytetramethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	215,253,303, 273,332	Conflicting data	160,261,344,429,446
	Poly(oxytrimethyleneoxycarbonyliminohexamethyleneiminocarbonyl)	328	Heating rate 10K/min	446
	Poly(oxyhexamethyleneoxycarbonyliminomethylene-1,4-phenylenemethyleneiminocarbonyl)	329	Heating rate 1K/min	445
	Poly(oxyheptamethyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	334	Heating rate 10K/min	446
	Poly(oxyhexamethyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	305	Heating rate 10K/min	446
	Poly(oxypentamethyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	325	Heating rate 10K/min	446
	Poly(oxytetramethyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	315	Heating rate 10K/min	446,454
	Poly(oxytrimethyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	345,213	Conflicting data	446,448
	Poly(oxydecamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	321	Heating rate 1K/min	445,446
	Poly(oxydodecamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	316	Heating rate 1K/min	445
	Poly(oxyheptamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	357	Heating rate 10K/min	446
	Poly(oxyhexamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	324	Heating rate 1K/min	445,446
	Poly(oxynonamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	345	Heating rate 10K/min	446
	Poly(oxyoctamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	352	Heating rate 10K/min	446
	Poly(oxypentamethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	368	Heating rate 10K/min	446
	Poly(oxytetramethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	382	Heating rate 10K/min	446
	Poly(oxytrimethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	392	Heating rate 10K/min	446
	Poly(oxymethylene-1,3-phenylenemethyleneoxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	379	Viscosity only 0.20	453
	Poly(oxyneopentyleneoxycarbonylimino-4-methyl-1,3-phenyleneiminocarbonyl)	241	DTA heating rate	448
3.2	Main-chain O-Heteroatom Polymers			
3.2.1	Poly(sulfonates)			
	Poly(oxysulfonyl-1,3-phenylenecarbonyl-1,3-phenylenesulfonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	395	Mechanical method	361
	Poly(oxysulfonyl-1,3-phenylenesulfonyloxy-1,4-phenyleneisopropylidene-1,4-phenylene)	$\sim$385	Not well defined; mechanical method	361

	Polymer	T_g(K)	Remarks	References
3.2	Main-chain O-Heteroatom Polymers (Cont'd.)			
3.2.2	Nitroso-polymers			
	Poly(oxy-2-bromotetrafluoroethyliminotetrafluoroethylene)	256	Heating rate 15K/min	455
	Poly(oxy-1,1-difluoroethyliminotetrafluoroethylene)	238	No measurement details	456
	Poly(oxytrifluoromethyliminotetrafluoroethylene)	219		423,457-462
	Polymer from trifluoronitrosomethane and bromotrifluoroethylene	276	Heating rate 15K/min	455,461
	Polymer from trifluoronitrosomethane and chlorotrifluoroethylene	248-253		423
	Polymer from trifluoronitrosomethane and perfluorobutadiene	266,230	Heating rate 15K/min; conflicting data	455,461
	Polymer from trifluoronitrosomethane and 1,1,2-trifluorobutadiene	218	No measurement details	456
	Polymer from trifluoronitrosomethane and trifluoromethyl trifluorovinyl ether	268	DSC heating rate	457
	Polymer from trifluoronitrosomethane and trifluoromethyl trifluorovinyl sulfide	225	No measurement details	461
	Polymer from trifluoronitrosomethane and hexafluoropropylene	264	No experimental details	456
3.2.3	Poly(siloxanes)			
	Poly(dimethylsiloxane) see Poly(oxydimethylsilylene)			
	Poly[oxydi(pentafluorophenyl)silylenedi(oxydimethylsilylene)]	231	No experimental details	463
	Poly[oxymethylchlorotetrafluorophenylsilylenedi(oxydimethylsilylene)]	198	No experimental details	463
	Poly(oxymethylpentafluorophenylsilylene)	248	No measurement details; $[\eta]$ only 0.2 dl/g	463
	Poly(oxymethylpentafluorophenylsilyleneoxydimethylsilylene)	208	No measurement details; $[\eta]$ only 0.24 dl/g	463
	Poly[oxymethylpentafluorophenylsilylenedi(oxydimethylsilylene)]	190	No measurement details	463
	Poly(oxymethyl-3,3,3-trifluoropropylsilylene)	< 193		421,423,464, 465,466
	Poly[oxy(methyl)-3,3,3-trifluoropropylsilyleneethylenedodecafluorohexamethylene-ethylene(methyl)-3,3,3-trifluoropropylsilylene]	249	DSC heating rate	466
	Poly[oxy(methyl)-3,3,3-trifluoropropylsilyleneethyleneeicosafluorodeca-methyleneethylene(methyl)-3,3,3-trifluoropropylsilylene]	262	DSC heating rate	466
	Poly[oxy(methyl)-3,3,3-trifluoropropylsilyleneethylenehexadecafluoroocta-methyleneethylene(methyl)-3,3,3-trifluoropropylsilylene]	245	DSC heating rate	466
	Poly[oxy(methyl)-3,3,3-trifluoropropylsilyleneethyleneoctafluorotetra-methyleneethylene(methyl)-3,3,3-trifluoropropylsilylene]	248	DSC heating rate	466
	Poly[oxy(methyl)-3,3,3-trifluoropropylsilylene-3,3-difluoropentamethylene-(methyl)-3,3,3-trifluoropropylsilylene]	235	DSC heating rate	466
	Poly[oxy(methyl)-3,3,3-trifluoropropylsilylene-3,3,4,4-tetrafluorohexa-methylene(methyl)-3,3,3-trifluoropropylsilylene]	246	DSC heating rate	466
	Poly[oxy(methyl)phenylsilylene]	187		467
	Poly[oxy(methyl)phenylsilyleneoxy-1,4-phenylene]	368	Low viscosity	468
	Poly[oxy(methyl)phenylsilyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene]	331	Low viscosity	468
	Poly(oxydimethylsilylene)	146		1,6,223,243, 467,469-474
	Poly(oxydimethylsilylene-2,4,5,6-tetrafluorophenylenedimethylsilylene)	245	No measurement details	463
	Poly(oxydimethylsilyleneneopentyleneoxyisophthaloyloxyneopentylene-dimethylsilylene)	221		430
	Poly(oxydimethylsilyleneneopentyleneoxyterephthaloyloxyneopentylene-dimethylsilylene)	238		431
	Poly[tri(oxydimethylsilylene)oxy(methyl)trimethylsiloxysilylene]	148		475
	Poly[tri(oxydimethylsilylene)oxy(methyl)-2-phenylethylsilylene]	171		475
	Poly[tri(oxydimethylsilylene)oxy(methyl)phenylsilylene]	201		475
	Poly[oxytri(dimethylsilyleneoxy)(methyl)phenylsilylene-1,3-phenylene-(methyl)phenylsilylene]	231	DTA heating rate	302
	Poly(oxydimethylsilyleneoxydimethylsilylene-2,4,5,6-tetrafluorophenylene-dimethylsilylene)	212	No measurement details	463
	Poly(oxydimethylsilyleneoxy-1,4-phenylene)	363	Mechanical method	468,476
	Poly(oxydimethylsilyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	318	Mechanical method	468,476
	Poly(oxydimethylsilylene-1,3-phenylenetetrafluoroethylene-1,3-phenylene-dimethylsilylene)	271	Heating rate 32K/min; crystalline samples	477
	Poly(oxydimethylsilylene-1,3-phenylenehexafluorotrimethylene-1,3-phenylene-dimethylsilylene)	265	Heating rate 32K/min	148
	Poly[di(oxydimethylsilylene)-1,4-phenylenedimethylsilylene]	210	DSC heating rate	478
	Poly[penta(oxydimethylsilylene)-1,4-phenylenedimethylsilylene]	193	DTA heating rate	302
	Poly[tetra(oxydimethylsilylene)-1,3-phenylenedimethylsilylene]	198	DTA heating rate	302

	Polymer	T_g(K)	Remarks	References
3.2.3	Poly(siloxanes) (Cont'd.)			
	Poly[tetra(oxydimethylsilylene)-1,4-phenylenedimethylsilylene]	201	DTA heating rate	302
	Poly[tri(oxydimethylsilylene)-1,4-phenylenedimethylsilylene]	211	DTA heating rate	302
	Poly(oxydimethylsilylene-1,4-phenyleneoxy-1,4-phenylenedimethylsilylene)	293	Heating rate 8K/min	301
	Poly[penta(oxydimethylsilylene)-1,4-phenyleneoxy-1,4-phenylenedimethylsilylene]	208	DTA heating rate	302
	Poly[tetra(oxydimethylsilylene)-1,4-phenyleneoxy-1,4-phenylenedimethylsilylene]	221	DTA heating rate	302
	Poly[tri(oxydimethylsilylene)-1,4-phenyleneoxy-1,4-phenylenedimethylsilylene]	236	DTA heating rate	302
	Poly[oxy-1,3-phenyleneoxy-5-(triphenylsiloxydimethylsilyl)isophthaloyl]	376	Heating rate 32K/min	438
	Poly(oxydiphenylsilyleneoxydimethylsilylene-1,4-phenylenedimethylsilylene)	~273	DSC heating rate	478
	Poly(oxydiphenylsilylene-1,3-phenylene)	~331	DTA heating rate	114
3.3	Main-chain -C-(S)-C- and -C-S-N-Polymers			
3.3.1	Poly(sulfides)			
	Poly(oxycarbonyloxy-2-methyl-1,4-phenylenethio-3-methyl-1,4-phenylene)	340	No experimental details	338
	Poly(oxycarbonyloxy-1,4-phenylenethio-1,4-phenylene)	~383	DTA heating rate	367
	Poly(oxyethylenedithioethylene)	220	Mechanical method	248,249
	Poly(oxyethylenetetrathioethylene)	233		248
	Poly(oxymethyleneoxyethylenedithioethylene)	214		248,249,283
	Poly(oxymethyleneoxytetramethylenedithiotetramethylene)	197		248
	Poly(oxytetramethylenedithiotetramethylene)	197		248,249
	Poly[thio-1-(allyloxymethyl)ethylene]	213		220
	Poly(thiocarbonyl fluoride) see Poly(thiodifluoromethylene)			
	Poly(thio-1,2-cyclohexylene)	~256,~228	Conflicting data	479,480
	Poly(thio-1,3-cyclohexylene)	221	DTA heating rate	480
	Poly(thioethylene)	possibly ~253	Interpretation difficult	481-483
	Poly(dithioethylene)	246	Mechanical method	248,249
	Poly(tetrathioethylene)	249		248,249
	Poly(thio-1-ethylethylene)	218		220
	Poly(thio-2-ethyl-2-methyltrimethylene)	~223		160
	Poly(thiodifluoromethylene)	155		484-486
	Poly(thiomethylene)	218	No measurement details	482
	Poly(thiotrimethylene)	~228	Conflicting data	480,487,488
	Poly(dithiodecamethylene)	208	DTA heating rate	489
	Poly(dithiohexamethylene)	199		248
	Poly(dithiopentamethylene)	201		248
	Poly(trithiodecamethylene)	203	DTA heating rate	489
	Poly(tetrathiodecamethylene)	197	DTA heating rate	489
	Poly(dithiomethylene-1,4-phenylenemethylene)	296	DTA heating rate	249,489
	Poly(tetrathiomethylene-1,4-phenylenemethylene)	276	DTA heating rate	489
	Poly(trithiomethylene-1,4-phenylenemethylene)	291	DTA heating rate	489
	Poly(thio-1-methyltrimethylene)	214	DSC heating rate	490
	Poly(thioneopentylene)	233	Heating rate 20K/min	160,480
	Poly(thio-1,4-phenylene)	370	DSC heating rate	305,307,493,494
	Poly(thiopropylene)	226		220,482,483,495,496
	Thiokols see Poly(thiomethylene)s			
3.3.2	Poly(thioesters)			
	Poly(thio-3-methyl-6-oxohexamethylene)	293	DTA heating rate	497
	Poly(thio-1-methyl-3-oxotrimethylene)	285		498
	Poly(thio-6-oxohexamethylene)	292	DTA heating rate	499
3.3.3	Poly(sulfones), Poly(sulfonamides)			
	Poly(oxy-2-acetoxytrimethyleneoxy-1,4-phenylenesulfonyl-1,4-phenylene)	403		219
	Poly(oxy-4,4'-biphenylyleneoxy-1,4-phenylenesulfonyl-1,4-phenylene)	503	Mechanical method	116
	Poly(oxycarbonylneopentylenesulfonylneopentylene)	323		160

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	Polymer	T_g(K)	Remarks	References
3.3.3	Poly(sulfones). Poly(sulfonamides) (Cont' d.)			
	Poly[oxycarbonyldi(oxy-1,4-phenylene)sulfonyl-1,4-phenyleneoxy-1,4-phenylene]	~ 478	Mechanical method	228
	Poly(oxy-2-hydroxytrimethyleneoxy-1,4-phenylenesulfonyl-1,4-phenylene)	428		219
	Poly(oxytetramethyleneoxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	413	Mechanical method	116
	Poly(oxyneopentylenesulfonylneopentyleneoxycarbonyliminohexamethylene-iminocarbonyl)	303		160
	Poly(oxy-5-pentyloxyisophthaloyloxy-1,4-phenylenesulfonyl-1,4-phenylene)	443	Heating rate 20K/min: η_{inh} only 0.11	313
	Poly(oxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxy-1,4-phenylenesulfonyl-methyliminotetramethylenemethyliminosulfonyl-1,4-phenylene)	393	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfinyl-1,4-phenyleneoxy-1,4-phenylenecarbonyl-1,4-phenylene)	478	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfinyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	438	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-4,4'-biphenylylenesulfonyl-1,4-phenylene)	533		184
	Poly(oxy-1,4-phenylenesulfonyl-2,7-naphthylenesulfonyl-1,4-phenylene)	523		184
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenylene)	487	Calculated T_g for infinite molecular weight: 511 K (ref.316)	116,184,314-316
	Poly[di(oxy-1,4-phenylene)sulfonyl-1,4-phenylene]	483	Mechanical method	116
	Poly[tri(oxy-1,4-phenylene)sulfonyl-1,4-phenylene]	453	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-2-chloro-1,4-phenyleneiso-propylidene-3-chloro-1,4-phenylene)	478	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-2,6-dimethyl-1,4-phenylene-isopropylidene-3,5-dimethyl-1,4-phenylene)	508	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenecarbonyl-1,4-phenylene)	478	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenecyclohexylidene-1,4-phenylene)	478	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenyleneethylidene-1,3-cyclohexylene-1,4-phenylene)	503	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenehexafluoro-2,2-propylidene-1,4-phenylene)	478	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenyleneisobutylidene-1,4-phenylene)	473	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenylene)	449		102,116,262,287,316-323
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenemethylene-1,4-phenylene)	453	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenemethylphenyl-methylene-1,4-phenylene)	473	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylene-2,2-norbornylene-1,4-phenylene)	523	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenediphenylmethylene-1,4-phenylene)	503	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxy-1,4-phenylenethio-1,4-phenylene)	448	Mechanical method	116
	Poly(oxy-1,4-phenylenesulfonyl-1,4-phenyleneoxyterephthaloyl)	522	Heating rate 20K/min	313
	Poly(oxyterephthaloyloxyneopentylenesulfonylneopentylene)	378	? DTA heating rate: η low	160
	Poly(sulfonyl-1,2-cyclohexylene)	401	Heating rate 20K/min	480
	Poly(sulfonyl-1,3-cyclohexylene)	381	Heating rate 20K/min	480
	Poly(sulfonylneopentylene)	386	Heating rate 20K/min	160,480
	Poly(sulfonyl-1,4-phenylenemethylene-1,4-phenylene)	497	Heating rate 40K/min; calculated T_g at infinite molecular weight: 511K	316

3.4 Main-chain -C-N-C-Polymers

3.4.1 Poly(amides)

Poly(ε-caprolactam) see Nylon 6

Poly(hexamethylene adipamide) see Nylon 6,6

	Polymer		T_g(K)	Remarks	References
3.4.1	Poly(amides) (Cont' d.)				
	Nylon 3	[Poly(imino-1-oxotrimethylene)]	384	Crystalline, DTA heating rate	502
	Nylon 4,6	[Poly(iminotetramethyleneiminoadipoyl)]	316	Dynamic method	503
	Nylon 5,6	[Poly(iminopentamethyleneiminoadipoyl)]	318	Heating rate 2K/min	504,505
	Nylon 6	[Poly(imino-1-oxohexamethylene)]	313-360	Conflicting data, most values ~313-325K	1,75,101,122,187, 191,261,262,318, 394,396,399,416, 506-520
	Nylon 6,6	[Poly(iminoadipoyliminohexamethylene)]	~323	Conflicting data, most values about 323K	6,75,78,161,170,171, 191,234,261,262,272, 317,326,344,381,388, 394,396,399,506,510, 521,522-533
	Nylon 6,7	[Poly(iminohexamethyleneiminopimeloyl)]	331		492,506
	Nylon 6,8	[Poly(iminohexamethyleneiminosuberoyl)]	330	Heating rate 0.5K/min	506
	Nylon 6,9	[Poly(iminohexamethyleneiminoazelaoyl)]	331		521
	Nylon 6,10	[Poly(iminohexamethyleneiminosebacoyl)]	323	Variable data below 323K	75,161,166,167,191, 399,503,505,506, 528,534,535
	Nylon 6,12	[Poly(iminohexamethyleneiminododecanedioyl)]	319	Heating rate 0.5K/min	506,535,536
	Nylon 7	[Poly(imino-1-oxoheptamethylene)]	325		191,506,537,538
	Nylon 7,6	[Poly(iminoadipoyliminoheptamethylene)]	318,333	Conflicting data	282,492,505,506
	Nylon 7,7	[Poly(iminopimeloyliminoheptamethylene)]	328	Heating rate 0.5K/min	506
	Nylon 8	[Poly(imino-1-oxooctamethylene)]	323		538
	Nylon 8,6	[Poly(iminoadipoyliminooctamethylene)]	318	Heating rate 2K/min	505
	Nylon 8,10	[Poly(iminooctamethyleneiminodecanedioyl)]	333	Heating rate 2K/min	505
	Nylon 8,12	[Poly(iminooctamethyleneiminododecanedioyl)]	323	Dynamic method	535
	Nylon 8,22	[Poly(iminooctamethyleneiminodocosanedioyl)]	321	Dynamic method	535
	Nylon 9	[Poly(imino-1-oxononamethylene)]	319		506;537;538
	Nylon 9,6	[Poly(iminoadipoyliminononamethylene)]	318	Estimated	504
	Nylon 10	[Poly(imino-1-oxodecamethylene)]	315		538
	Nylon 10,6	[Poly(iminoadipoyliminodecamethylene)]	313	Heating rate 2K/min	505
	Nylon 10,10	[Poly(iminosebacoyliminodecamethylene)]	333,319	Conflicting data	505,506
	Nylon 10,12	[Poly(iminodecamethyleneiminododecanedioyl)]	322	Dynamic method	535
	Nylon 11	[Poly(imino-1-oxoundecamethylene)]	316,365	Transitions affected by thermal history and relaxation effects	75,191,506,518, 538
	Nylon 12	[Poly(imino-1-oxododecamethylene)]	314	Affected by thermal history and relaxation effects	75,520,538
	Nylon 12,18	[Poly(iminododecamethyleneiminooctadecanedioyl)]	323	Dynamic method	535
	Nylon 13	[Poly(imino-1-oxotridecamethylene)]	314		538
	Nylon 14,18	[Poly(iminotetradecamethyleneiminooctadecanedioyl)]	321	Dynamic method	535
	Nylon 18,18	[Poly(iminooctadecanedioyliminooctadecamethylene)]	323	Dynamic method	535,536
	Poly(γ-benzyl L-glutamate)		~288	Dynamic method	273
	Poly(butyliminohexafluoroglutarylbutyliminohexamethylene)		~293	Brittle point	539
	Poly(butylimino-2,2,3,3,4,4-hexafluoropentamethylenebutyliminoadipoyl)		283-288	Brittle point	539
	Poly(ethyliminohexafluoroglutarylethyliminohexamethylene)		~278	Brittle point	539
	Poly(ethylimino-2,2,3,3,4,4-hexafluoropentamethyleneethyliminoadipoyl)		293	Brittle point	539
	Poly(iminoadipoylimino-1,4-cyclohexylenemethylene-1,4-cyclohexylene) 98% trans/trans, 2% cis/trans		458	T_g depends on cis/trans isomer content	540
	Poly(iminoadipoyliminotrimethylenefluoren-9-ylidenetrimethylene)		393	Mechanical method, heating rate 1K/min	78,161
	Poly(iminoadipoyliminotrimethyleneisobutylphosphinidenetrimethylene)		344	DTA heating rate	492
	Poly(iminoadipoyliminotrimethylenemethyliminotrimethylene)		278		492
	Poly(iminoadipoyliminomethylene-2,5-dimethyl-1,4-phenylenemethylene)		343	DTA heating rate	303
	Poly(iminoadipoyliminotrimethylenemethylphosphinylidenetetramethylene)		332	DTA heating rate	492
	Poly(iminoadipoyliminotrimethylenemethylphosphinylidenetrimethylene)		332	DTA heating rate	492
	Poly(iminoadipoyliminotrimethyleneoctylphosphinylidenetrimethylene)		285	DTA heating rate	492
	Poly[iminoadipoyliminotrimethylene(phenylphosphinidene)trimethylene]		322		492
	Poly[iminoadipoyliminotrimethylene(phenylphosphinylidene)trimethylene]		328		492
	Poly(imino-5-tert-butylisophthaloyliminohexamethylene)		436	DTA heating rate	453
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,4-cyclohexylenemethylene)		509	DTA heating rate	453

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	Polymer	T_g(K)	Remarks	References
3.4.1	Poly(amides) (Cont' d.)			
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,3-phenylenemethylene)	465	DTA heating rate	453
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,4-phenylenemethylene)	477	DTA heating rate	453
	Poly[imino-5-tert-butylisophthaloylimino(2,5-dimethylhexamethylene)]	422	DTA heating rate	453
	Poly[imino-5-tert-butylisophthaloylimino(3,4-dimethylhexamethylene)]	446	DTA heating rate	453
	Poly(iminocarbonyl-1,3-adamantylenecarbonyliminohexamethylene)	~ 385	Values from 378-393K obtained	255
	Poly(iminocarbonyl-2,2'-biphenylylenecarbonyliminotrimethylenefluoren-9-ylidenetrimethylene)	438	Mechanical method, heating rate 1K/min	78,161
	Poly(iminocarbonyl-1,4-cyclohexylenemethylene)	466	DTA heating rate	517
	Poly(iminocarbonyl-1,4-phenylene-2-oxoethyleneiminohexamethylene)	377	Heating rate 20K/min	541
	Poly(imino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminododecanedioyl) 98% trans/trans, 2% cis/trans	408	T_g depends on cis/trans isomer content	540
	Poly(imino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminosebacoyl) 98% trans/trans, 2% cis/trans	417	T_g depends on cis/trans isomer content	540
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,16-dioxohexadecamethylene)	358	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,18-dioxooctadecamethylene)	348	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,14-dioxotetradecamethylene)	366	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,11-dioxoundecamethylene)	369	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneiminosebacoyl)	378	Dynamic method	536
	Poly(iminoglutarylimino-2,2-dimethylpentamethylene)	355	DTA heating rate	542
	Poly(iminoisophthaloylimino-4,4'-biphenylylene)	558	DTA heating rate	311,312
	Poly(iminoisophthaloyliminohexamethylene)	390		78,161,255,543
	Poly(iminoisophthaloyliminooctamethylene)	388	Dynamic method	544
	Poly(iminoisophthaloyliminomethylene-1,4-cyclohexylenemethylene)	481	DSC heating rate	453
	Poly(iminoisophthaloyliminotrimethylenefluoren-9-ylidenetrimethylene)	448	Mechanical method	78,161
	Poly(iminoisophthaloyliminomethylene-1,3-phenylenemethylene)	438	Mechanical method, heating rate 1K/min	78,161,453
	Poly(iminoisophthaloylimino-3,4-dimethylhexamethylene)	398	DSC heating rate	453
	Poly(iminoisophthaloylimino-2,2-dimethylpentamethylene)	426	DTA heating rate	308
	Poly(iminoisophthaloylimino-1,4-phenylenemethylene-1,4-phenylene)	> 500	Dynamic method	311
	Poly(iminomesaconoyliminodecamethylene)	347	Heating rate 16K/min	545
	Poly(iminomesaconoyliminohexamethylene)	367	Heating rate 16K/min	545
	Poly(iminomesaconoyliminomethylene-1,3-phenylenemethylene)	408	Heating rate 16K/min	545
	Poly(imino-3-methyladipoyliminohexamethylene)	290	DTA heating rate	492
	Poly(iminomethylene-5-tert-butyl-1,3-cyclohexylenemethyleneiminoisophthaloyl)	482	DSC heating rate	453
	Poly(iminomethylene-5-tert-butyl-1,3-phenylenemethyleneiminoadipoyl)	382	DTA heating rate	453
	Poly(iminomethylene-5-tert-butyl-1,3-phenylenemethyleneiminoisophthaloyl)	461	DSC heating rate	453
	Poly(iminomethylene-1,3-cyclohexylenemethyleneimino-5-tert-butylisophthaloyl)	473	DTA heating rate	453
	Poly(iminomethylene-1,3-cyclohexylenemethyleneiminoisophthaloyl)	453	DSC heating rate	453
	Poly(iminotrimethylenefluoren-9-ylidenetrimethyleneiminosebacoyl)	358	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneiminocarbonyl-2,2'-biphenylylenecarbonyl)	400	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneiminocarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	427-437		165
	Poly(iminotetramethyleneiminocarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	446-455		165
	Poly(iminopentamethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	376	Heating rate 20K/min	541
	Poly(iminotetramethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	357	Heating rate 20K/min	541
	Poly(iminotrimethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	332	Heating rate 20K/min	541
	Poly(iminohexamethyleneimino-4-methylpimeloyl)	323		521
	Poly(iminooctamethyleneimino-1-oxoethylene-1,4-phenylene-2-oxoethylene)	383	Dynamic method	536
	Poly(iminohexamethyleneimino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethylene)	395	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneimino-1-oxotrimethylenephenylphosphinothioylidene-3-oxotrimethylene)	316		492
	Poly(iminohexamethyleneimino-1-oxotrimethylenephenylphosphinylidene-3-oxotrimethylene)	302		492
	Poly(iminopentamethyleneiminoterephthaloyl)	~ 500	Dynamic method	513
	Poly(iminomethylene-1,3,3-trimethyl-1,5-cyclohexyleneiminoadipoyl)	433	No experimental details	381
	Poly(iminomethylene-1,3,3-trimethyl-1,5-cyclohexyleneiminoterephthaloyl)	473	No experimental details	381
	Poly[iminomethylene(2,5-dimethyl-1,4-phenylene)methyleneiminosuberoyl]	351	DTA heating rate	303
	Poly(iminomethylene-1,3-phenylenemethyleneiminoadipoyl)	346	Mechanical method, heating rate 1K/min	78

	Polymer	T_g (K)	Remarks	References
3.4.1	Poly(amides) (Cont'd.)			
	Poly(iminomethylene-1,3-phenylenemethyleneiminocarbonyl-2,2'-biphenylylenecarbonyl)	432	Mechanical method, heating rate 1K/min	78
	Poly[iminomethylene-1,4-phenylenemethyleneiminocarbonyl(1,3,3-trimethyl-5-oxopentamethylene)]	398	No experimental details	381
	Poly(iminomethylene-1,4-phenylenemethyleneiminododecanedioyl)	378		491,536
	Poly(iminomethylene-1,4-phenylenemethyleneiminooctadecanedioyl)	348	Dynamic method	536
	Poly(iminomethylene-1,3-phenylenemethyleneimino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethylene)	423	Mechanical method, heating rate 1K/min	78,161
	Poly(iminomethylene-1,4-phenylenemethyleneiminopentadecanedioyl)	363	Dynamic method	536
	Poly(iminomethylene-1,4-phenylenemethyleneiminosebacoyl)	388	Dynamic method	536
	Poly(iminomethylene-1,4-phenylenemethyleneiminotridecanedioyl)	373	Dynamic method	536
	Poly(iminomethylene-1,4-phenylenemethyleneiminoundecanedioyl)	380		491,536
	Poly(imino-5-methylisophthaloyliminohexamethylene)	393		255
	Poly(imino-1-methyl-3-oxotrimethylene)	369	Crystalline; DTA heating rate	502
	Poly(imino-2,2-dimethylpentamethyleneiminoadipoyl)	350	DTA heating rate	542
	Poly(imino-2,4,4-trimethylhexamethyleneiminoadipoyl)	338	No measurement details	381
	Poly(imino-2,2-dimethylpentamethyleneiminoazelaoyl)	336	DTA heating rate	542
	Poly(imino-2,2-dimethylpentamethyleneiminopimeloyl)	344	DTA heating rate	542
	Poly(imino-2,2-dimethylpentamethyleneiminoterephthaloyl)	430	DTA heating rate	308
	Poly(imino-1,5-naphthyleneiminoisophthaloyl)	598	DTA heating rate	312
	Poly(imino-1,5-naphthyleneiminoterephthaloyl)	578	Heating rate 10K/min	312
	Poly(iminooxalylimino-2,2-dimethylpentamethylene)	382	DTA heating rate	542
	Poly(imino-1-oxoethylene-1,4-phenylene-2-oxoethyleneiminooctadecamethylene)	351	Dynamic method	536
	Poly(imino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethyleneiminotrimethylenefluoren-9-ylidenetrimethylene)	438	Mechanical method, heating rate 1K/min	78
	Poly(imino-1-oxotrimethylene-1,4-phenylene-3-oxotrimethyleneiminododecamethylene)	358	Dynamic method	536
	Poly(imino-1-oxotrimethylene-1,4-phenylene-3-oxotrimethyleneiminooctadecamethylene)	338	Dynamic method	536
	Poly(imino-1,3-phenyleneiminocarbonyl-1,3-adamantylenecarbonyl)	580	Heating rate 32K/min	255
	Poly(imino-1,3-phenyleneiminoisophthaloyl)	553	Mechanical method, heating rate 2K/min	311,518,546
	Poly(imino-1,4-phenyleneiminoisophthaloyl)	> 500	Dynamic method	311
	Poly(imino-1,3-phenyleneimino-5-methylisophthaloyl)	578	Heating rate 32K/min	255
	Poly(imino-1,3-phenyleneiminosebacoyl)	383	Dynamic method	544
	Poly(imino-1,3-phenyleneiminoterephthaloyl)	> 500	Dynamic method	311
	Poly(imino-1,4-phenyleneiminoterephthaloyl)	618	Heating rate 10K/min	311,312
	Poly(iminoterephthaloylimino-4,4'-biphenylylene)	613	DTA heating rate	311,312
	Poly(iminoterephthaloylimino-3-ethylhexamethylene)	403	DSC heating rate	381
	Poly(iminoterephthaloylimino-3-isopropylhexamethylene)	416	DSC heating rate	381
	Poly(iminoterephthaloyliminododecamethylene)	393	Dynamic method	543,547
	Poly(iminoterephthaloyliminoheptamethylene)	470	Dynamic method	518
	Poly(iminoterephthaloyliminohexamethylene)	413	No experimental details	381
	Poly(iminoterephthaloyliminononamethylene)	388	No experimental details	381
	Poly(iminoterephthaloyliminomethylene-2,5-dimethyl-1,4-phenylenemethylene)	498	DTA heating rate	303
	Poly(iminoterephthaloylimino-4,4-dimethylheptamethylene)	425	No experimental details	381
	Poly(iminoterephthaloylimino-1,4,4-trimethylheptamethylene)	423	DTA heating rate	548
	Poly(iminoterephthaloylimino-2,2,4-trimethylhexamethylene)	418	DSC heating rate	262,381
	Poly(iminoterephthaloylimino-2,4,4-trimethylhexamethylene)	421,432	Two different samples; DSC heating rate	381
	Poly(iminoterephthaloylimino-1,4-phenylenemethylene-1,4-phenylene)	> 500	Dynamic method	311
	Poly(isopropyliminohexafluoroglutarylisopropyliminohexamethylene)	~ 293	Brittle point	539
	Poly(isopropylimino-2,2,3,3,4,4-hexafluoropentamethyleneisopropyliminoadipoyl)	303-308	Brittle point	539
	Poly(methyliminohexafluoroglutarylmethyliminohexamethylene)	298-303	Brittle point	539
	Poly(methylimino-2,2,3,3,4,4-hexafluoropentamethylenemethyliminoadipoyl)	298-303	Brittle point	539
	Poly[di(oxyethylene)oxycarbonyliminohexamethyleneiminocarbonyl]	272	Heating rate 1-2K/min	245
	Poly[tri(oxyethylene)oxycarbonyliminohexamethyleneiminocarbonyl]	260		246
	Poly(oxytrimethyleneiminoadipoyliminotrimethylene)	307		282
	Poly(oxy-3-oxotrimethyleneiminomethylene-2,5-dimethyl-1,4-phenylenemethyleneimino-1-oxotrimethylene)	353	DTA heating rate	303

	Polymer	T_g(K)	Remarks	References
3.4.1	Poly(amides) (Cont'd.)			
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,3-phenylenemethylene)	465	DTA heating rate	453
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,4-phenylenemethylene)	477	DTA heating rate	453
	Poly[imino-5-tert-butylisophthaloylimino(2,5-dimethylhexamethylene)]	422	DTA heating rate	453
	Poly[imino-5-tert-butylisophthaloylimino(3,4-dimethylhexamethylene)]	446	DTA heating rate	453
	Poly(iminocarbonyl-1,3-adamantylenecarbonyliminohexamethylene)	~ 385	Values from 378-393K obtained	255
	Poly(iminocarbonyl-2,2'-biphenylylenecarbonyliminotrimethylenefluoren-9-ylidenetrimethylene)	438	Mechanical method, heating rate 1K/min	78,161
	Poly(iminocarbonyl-1,4-cyclohexylenemethylene)	466	DTA heating rate	517
	Poly(iminocarbonyl-1,4-phenylene-2-oxoethyleneiminohexamethylene)	377	Heating rate 20K/min	541
	Poly(imino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminododecanedioyl) 98% trans/trans, 2% cis/trans	408	T_g depends on cis/trans isomer content	540
	Poly(imino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminosebacoyl) 98% trans/trans, 2% cis/trans	417	T_g depends on cis/trans isomer content	540
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,16-dioxohexadecamethylene)	358	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,18-dioxooctadecamethylene)	348	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,14-dioxotetradecamethylene)	366	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,11-dioxoundecamethylene)	369	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneiminosebacoyl)	378	Dynamic method	536
	Poly(iminoglutaryliminо-2,2-dimethylpentamethylene)	355	DTA heating rate	542
	Poly(iminoisophthaloylimino-4,4'-biphenylylene)	558	DTA heating rate	311,312
	Poly(iminoisophthaloyliminohexamethylene)	390		78,161,255,543
	Poly(iminoisophthaloyliminooctamethylene)	388	Dynamic method	544
	Poly(iminoisophthaloyliminomethylene-1,4-cyclohexylenemethylene)	481	DSC heating rate	453
	Poly(iminoisophthaloyliminotrimethylenefluoren-9-ylidenetrimethylene)	448	Mechanical method	78,161
	Poly(iminoisophthaloyliminomethylene-1,3-phenylenemethylene)	438	Mechanical method, heating rate 1K/min	78,161,453
	Poly(iminoisophthaloylimino-3,4-dimethylhexamethylene)	398	DSC heating rate	453
	Poly(iminoisophthaloylimino-2,2-dimethylpentamethylene)	426	DTA heating rate	308
	Poly(iminoisophthaloylimino-1,4-phenylenemethylene-1,4-phenylene)	> 500	Dynamic method	311
	Poly(iminomesaconoyliminodecamethylene)	347	Heating rate 16K/min	545
	Poly(iminomesaconoyliminohexamethylene)	367	Heating rate 16K/min	545
	Poly(iminomesaconoyliminomethylene-1,3-phenylenemethylene)	408	Heating rate 16K/min	545
	Poly(imino-3-methyladipoyliminohexamethylene)	290	DTA heating rate	492
	Poly(iminomethylene-5-tert-butyl-1,3-cyclohexylenemethyleneiminoisophthaloyl)	482	DSC heating rate	453
	Poly(iminomethylene-5-tert-butyl-1,3-phenylenemethyleneiminoadipoyl)	382	DTA heating rate	453
	Poly(iminomethylene-5-tert-butyl-1,3-phenylenemethyleneiminoisophthaloyl)	461	DSC heating rate	453
	Poly(iminomethylene-1,3-cyclohexylenemethyleneimino-5-tert-butylisophthaloyl)	473	DTA heating rate	453
	Poly(iminomethylene-1,3-cyclohexylenemethyleneiminoisophthaloyl)	453	DSC heating rate	453
	Poly(iminotrimethylenefluoren-9-ylidenetrimethyleneiminosebacoyl)	358	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneiminocarbonyl-2,2'-biphenylylenecarbonyl)	400	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneiminocarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	427-437		165
	Poly(iminotetramethyleneiminocarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	446-455		165
	Poly(iminopentamethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	376	Heating rate 20K/min	541
	Poly(iminotetramethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	357	Heating rate 20K/min	541
	Poly(iminotrimethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	382	Heating rate 20K/min	541
	Poly(iminohexamethyleneimino-4-methylpimeloyl)	323		521
	Poly(iminooctamethyleneimino-1-oxoethylene-1,4-phenylene-2-oxoethylene)	383	Dynamic method	536
	Poly(iminohexamethyleneimino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethylene)	395	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneimino-1-oxotrimethylenephenylphosphinothioylidene-3-oxotrimethylene)	316		492
	Poly(iminohexamethyleneimino-1-oxotrimethylenephenylphosphinylidene-3-oxotrimethylene)	302		492
	Poly(iminopentamethyleneiminoterephthaloyl)	~ 500	Dynamic method	518
	Poly(iminomethylene-1,3,3-trimethyl-1,5-cyclohexyleneiminoadipoyl)	433	No experimental details	381
	Poly(iminomethylene-1,3,3-trimethyl-1,5-cyclohexyleneiminoterephthaloyl)	473	No experimental details	381
	Poly[iminomethylene(2,5-dimethyl-1,4-phenylene)methyleneiminosuberoyl]	351	DTA heating rate	303
	Poly(iminomethylene-1,3-phenylenemethyleneiminoadipoyl)	346	Mechanical method, heating rate 1K/min	78

	Polymer	T_g(K)	Remarks	References
3.4.1	Poly(amides) (Cont'd.)			
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,3-phenylenemethylene)	465	DTA heating rate	453
	Poly(imino-5-tert-butylisophthaloyliminomethylene-1,4-phenylenemethylene)	477	DTA heating rate	453
	Poly[imino-5-tert-butylisophthaloylimino(2,5-dimethylhexamethylene)]	422	DTA heating rate	453
	Poly[imino-5-tert-butylisophthaloylimino(3,4-dimethylhexamethylene)]	446	DTA heating rate	453
	Poly(iminocarbonyl-1,3-adamantylenecarbonyliminohexamethylene)	~ 385	Values from 378-393K obtained	255
	Poly(iminocarbonyl-2,2'-biphenylylenecarbonyliminotrimethylenefluoren-9-ylidenetrimethylene)	438	Mechanical method, heating rate 1K/min	78,161
	Poly(iminocarbonyl-1,4-cyclohexylenemethylene)	466	DTA heating rate	517
	Poly(iminocarbonyl-1,4-phenylene-2-oxoethyleneiminohexamethylene)	377	Heating rate 20K/min	541
	Poly(imino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminododecanedioyl) 98% trans/trans, 2% cis/trans	408	T_g depends on cis/trans isomer content	540
	Poly(imino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminosebacoyl) 98% trans/trans, 2% cis/trans	417	T_g depends on cis/trans isomer content	540
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,16-dioxohexadecamethylene)	358	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,18-dioxooctadecamethylene)	348	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,14-dioxotetradecamethylene)	366	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneimino-1,11-dioxoundecamethylene)	369	Dynamic method	536
	Poly(iminoethylene-1,4-phenyleneethyleneiminosebacoyl)	378	Dynamic method	536
	Poly(iminoglutarylimino-2,2-dimethylpentamethylene)	355	DTA heating rate	542
	Poly(iminoisophthaloylimino-4,4'-biphenylylene)	558	DTA heating rate	311,312
	Poly(iminoisophthaloyliminohexamethylene)	390		78,161,255,543
	Poly(iminoisophthaloyliminooctamethylene)	388	Dynamic method	544
	Poly(iminoisophthaloyliminomethylene-1,4-cyclohexylenemethylene)	481	DSC heating rate	453
	Poly(iminoisophthaloyliminotrimethylenefluoren-9-ylidenetrimethylene)	448	Mechanical method	78,161
	Poly(iminoisophthaloyliminomethylene-1,3-phenylenemethylene)	438	Mechanical method, heating rate 1K/min	78,161,453
	Poly(iminoisophthaloylimino-3,4-dimethylhexamethylene)	398	DSC heating rate	453
	Poly(iminoisophthaloylimino-2,2-dimethylpentamethylene)	426	DTA heating rate	308
	Poly(iminoisophthaloylimino-1,4-phenylenemethylene-1,4-phenylene)	> 500	Dynamic method	311
	Poly(iminomesaconoyliminodecamethylene)	347	Heating rate 16K/min	545
	Poly(iminomesaconoyliminohexamethylene)	367	Heating rate 16K/min	545
	Poly(iminomesaconoyliminomethylene-1,3-phenylenemethylene)	403	Heating rate 16K/min	545
	Poly(imino-3-methyladipoyliminohexamethylene)	290	DTA heating rate	492
	Poly(iminomethylene-5-tert-butyl-1,3-cyclohexylenemethyleneiminoisophthaloyl)	482	DSC heating rate	453
	Poly(iminomethylene-5-tert-butyl-1,3-phenylenemethyleneiminoadipoyl)	382	DTA heating rate	453
	Poly(iminomethylene-5-tert-butyl-1,3-phenylenemethyleneiminoisophthaloyl)	461	DSC heating rate	453
	Poly(iminomethylene-1,3-cyclohexylenemethyleneimino-5-tert-butylisophthaloyl)	473	DTA heating rate	453
	Poly(iminomethylene-1,3-cyclohexylenemethyleneiminoisophthaloyl)	453	DSC heating rate	453
	Poly(iminotrimethylenefluoren-9-ylidenetrimethyleneiminosebacoyl)	358	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneiminocarbonyl-2,2'-biphenylylenecarbonyl)	400	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneiminocarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	427-437		165
	Poly(iminotetramethyleneiminocarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	446-455		165
	Poly(iminopentamethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	376	Heating rate 20K/min	541
	Poly(iminotetramethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	357	Heating rate 20K/min	541
	Poly(iminotrimethyleneiminocarbonyl-1,4-phenylene-2-oxoethylene)	382	Heating rate 20K/min	541
	Poly(iminohexamethyleneimino-4-methylpimeloyl)	323		521
	Poly(iminooctamethyleneimino-1-oxoethylene-1,4-phenylene-2-oxoethylene)	383	Dynamic method	536
	Poly(iminohexamethyleneimino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethylene)	395	Mechanical method, heating rate 1K/min	78,161
	Poly(iminohexamethyleneimino-1-oxotrimethylenephenylphosphinothioylidene-3-oxotrimethylene)	316		492
	Poly(iminohexamethyleneimino-1-oxotrimethylenephenylphosphinylidene-3-oxotrimethylene)	302		492
	Poly(iminopentamethyleneiminoterephthaloyl)	~ 500	Dynamic method	513
	Poly(iminomethylene-1,3,3-trimethyl-1,5-cyclohexyleneiminoadipoyl)	433	No experimental details	331
	Poly(iminomethylene-1,3,3-trimethyl-1,5-cyclohexyleneiminoterephthaloyl)	473	No experimental details	331
	Poly[iminomethylene(2,5-dimethyl-1,4-phenylene)methyleneiminosuberoyl]	351	DTA heating rate	303
	Poly(iminomethylene-1,3-phenylenemethyleneiminoadipoyl)	346	Mechanical method, heating rate 1K/min	78

	Polymer	T_g (K)	Remarks	References
3.4.1	Poly(amides) (Cont'd.)			
	Poly(iminomethylene-1,3-phenylenemethyleneiminocarbonyl-2,2'-biphenylylenecarbonyl)	432	Mechanical method, heating rate 1K/min	78
	Poly[iminomethylene-1,4-phenylenemethyleneiminocarbonyl(1,3,3-trimethyl-5-oxopentamethylene)]	398	No experimental details	381
	Poly(iminomethylene-1,4-phenylenemethyleneiminododecanedioyl)	378		491,536
	Poly(iminomethylene-1,4-phenylenemethyleneiminooctadecanedioyl)	348	Dynamic method	536
	Poly(iminomethylene-1,3-phenylenemethyleneimino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethylene)	423	Mechanical method, heating rate 1K/min	78,161
	Poly(iminomethylene-1,4-phenylenemethyleneiminopentadecanedioyl)	363	Dynamic method	536
	Poly(iminomethylene-1,4-phenylenemethyleneiminosebacoyl)	388	Dynamic method	536
	Poly(iminomethylene-1,4-phenylenemethyleneiminotridecanedioyl)	373	Dynamic method	536
	Poly(iminomethylene-1,4-phenylenemethyleneiminoundecanedioyl)	380		491,536
	Poly(imino-5-methylisophthaloyliminohexamethylene)	393		255
	Poly(imino-1-methyl-3-oxotrimethylene)	369	Crystalline; DTA heating rate	502
	Poly(imino-2,2-dimethylpentamethyleneiminoadipoyl)	350	DTA heating rate	542
	Poly(imino-2,4,4-trimethylhexamethyleneiminoadipoyl)	338	No measurement details	381
	Poly(imino-2,2-dimethylpentamethyleneiminoazelaoyl)	336	DTA heating rate	542
	Poly(imino-2,2-dimethylpentamethyleneiminopimeloyl)	344	DTA heating rate	542
	Poly(imino-2,2-dimethylpentamethyleneiminoterephthaloyl)	430	DTA heating rate	308
	Poly(imino-1,5-naphthyleneiminoisophthaloyl)	598	DTA heating rate	312
	Poly(imino-1,5-naphthyleneiminoterephthaloyl)	578	Heating rate 10K/min	312
	Poly(iminooxalylimino-2,2-dimethylpentamethylene)	382	DTA heating rate	542
	Poly(imino-1-oxoethylene-1,4-phenylene-2-oxoethyleneiminooctadecamethylene)	351	Dynamic method	536
	Poly(imino-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethyleneiminotrimethylenefluoren-9-ylidenetrimethylene)	438	Mechanical method, heating rate 1K/min	78
	Poly(imino-1-oxotrimethylene-1,4-phenylene-3-oxotrimethyleneiminododecamethylene)	358	Dynamic method	536
	Poly(imino-1-oxotrimethylene-1,4-phenylene-3-oxotrimethyleneiminooctadecamethylene)	338	Dynamic method	536
	Poly(imino-1,3-phenyleneiminocarbonyl-1,3-adamantylenecarbonyl)	580	Heating rate 32K/min	255
	Poly(imino-1,3-phenyleneiminoisophthaloyl)	553	Mechanical method, heating rate 2K/min	311,518,546
	Poly(imino-1,4-phenyleneiminoisophthaloyl)	> 500	Dynamic method	311
	Poly(imino-1,3-phenyleneimino-5-methylisophthaloyl)	578	Heating rate 32K/min	255
	Poly(imino-1,3-phenyleneiminosebacoyl)	383	Dynamic method	544
	Poly(imino-1,3-phenyleneiminoterephthaloyl)	> 500	Dynamic method	311
	Poly(imino-1,4-phenyleneiminoterephthaloyl)	618	Heating rate 10K/min	311,312
	Poly(iminoterephthaloylimino-4,4'-biphenylylene)	613	DTA heating rate	311,312
	Poly(iminoterephthaloylimino-3-ethylhexamethylene)	403	DSC heating rate	381
	Poly(iminoterephthaloylimino-3-isopropylhexamethylene)	416	DSC heating rate	381
	Poly(iminoterephthaloyliminododecamethylene)	393	Dynamic method	543,547
	Poly(iminoterephthaloyliminoheptamethylene)	470	Dynamic method	518
	Poly(iminoterephthaloyliminohexamethylene)	413	No experimental details	381
	Poly(iminoterephthaloyliminononamethylene)	388	No experimental details	381
	Poly(iminoterephthaloyliminomethylene-2,5-dimethyl-1,4-phenylenemethylene)	498	DTA heating rate	303
	Poly(iminoterephthaloylimino-4,4-dimethylheptamethylene)	425	No experimental details	381
	Poly(iminoterephthaloylimino-1,4,4-trimethylheptamethylene)	423	DTA heating rate	548
	Poly(iminoterephthaloylimino-2,2,4-trimethylhexamethylene)	418	DSC heating rate	262,381
	Poly(iminoterephthaloylimino-2,4,4-trimethylhexamethylene)	421,432	Two different samples; DSC heating rate	381
	Poly(iminoterephthaloylimino-1,4-phenylenemethylene-1,4-phenylene)	> 500	Dynamic method	311
	Poly(isopropyliminohexafluoroglutarylisopropyliminohexamethylene)	~293	Brittle point	539
	Poly(isopropylimino-2,2,3,3,4,4-hexafluoropentamethyleneisopropyliminoadipoyl)	303-308	Brittle point	539
	Poly(methyliminohexafluoroglutarylmethyliminohexamethylene)	298-303	Brittle point	539
	Poly(methylimino-2,2,3,3,4,4-hexafluoropentamethylenemethyliminoadipoyl)	298-303	Brittle point	539
	Poly[di(oxyethylene)oxycarbonyliminohexamethyleneiminocarbonyl]	272	Heating rate 1-2K/min	245
	Poly[tri(oxyethylene)oxycarbonyliminohexamethyleneiminocarbonyl]	260		246
	Poly(oxytrimethyleneiminoadipoyliminotrimethylene)	307		282
	Poly(oxy-3-oxotrimethyleneiminomethylene-2,5-dimethyl-1,4-phenylenemethyleneimino-1-oxotrimethylene)	353	DTA heating rate	303

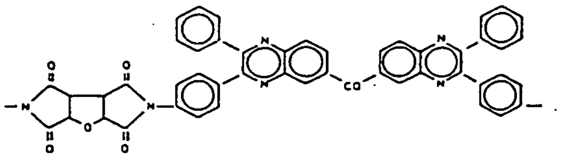
	Polymer	T_g(K)	Remarks	References
3.4.1	Poly(amides) (Cont' d.)			
	Poly(oxy-5-oxopentamethyleneiminomethylene-1,4-phenylenemethyleneimino-1-oxopentamethylene)	343	Estimated from copolymer data	304
	Poly(oxy-1,4-phenylenecarbonylimino-2,2-dimethylpentamethyleneiminocarbonyl-1,4-phenylene)	428	DTA heating rate	308
	Poly(oxy-1,4-phenylenecarbonylimino-1,4-phenylenesulfonyl-1,4-phenyleneiminocarbonyl-1,4-phenylene)	571	Softening point; mechanical method	309
	Poly(oxy-1,4-phenyleneiminoisophthaloylimino-1,4-phenylene)	463,554	Conflicting data	130,311,312
	Poly(oxy-1,4-phenyleneiminoterephthaloylimino-1,4-phenylene)	613	Heating rate 10K/min	311,312
	Poly(sulfonyl-1,3-phenyleneiminoadipoylimino-1,3-phenylene)	413	DTA heating rate	500,501
	Poly(sulfonyl-1,4-phenyleneiminoadipoylimino-1,4-phenylene)	467	DTA heating rate	500,501
	Poly(sulfonyl-1,3-phenyleneiminoazelaoylimino-1,3-phenylene)	398	DTA heating rate	500,501
	Poly(sulfonyl-1,4-phenyleneiminoazelaoylimino-1,4-phenylene)	451	DTA heating rate	500,501
	Poly(sulfonyl-1,3-phenyleneiminocarbonyl-1,4-naphthylenecarbonylimino-1,3-phenylene)	> 573	Softening point; mechanical method	309
	Poly(sulfonyl-1,4-phenyleneiminocarbonyl-1,4-naphthylenecarbonylimino-1,4-phenylene)	> 573	Softening point; mechanical method	309
	Poly(sulfonyl-1,4-phenyleneiminocarbonyl-1,4-phenylenemethylene-1,4-phenylenecarbonylimino-1,4-phenylene)	> 573	Softening point	309
	Poly(sulfonyl-1,3-phenyleneiminododecanedioylimino-1,3-phenylene)	380	DTA heating rate	500,501
	Poly(sulfonyl-1,4-phenyleneiminododecanedioylimino-1,4-phenylene)	433	DTA heating rate	500,501
	Poly(sulfonyl-1,3-phenyleneiminoisophthaloylimino-1,3-phenylene)	573-593	Softening point; mechanical method	309
	Poly(sulfonyl-1,4-phenyleneimino-2-methoxyisophthaloylimino-1,4-phenylene)	568-583	Softening point	309
	Poly(sulfonyl-1,4-phenyleneiminopimeloylimino-1,4-phenylene)	436	DTA heating rate	500,501
	Poly(sulfonyl-1,3-phenyleneiminosebacoylimino-1,3-phenylene)	385	DTA heating rate	500,501
	Poly(sulfonyl-1,4-phenyleneiminosebacoylimino-1,4-phenylene)	444	DTA heating rate	500,501
	Poly(sulfonyl-1,3-phenyleneiminosuberoylimino-1,3-phenylene)	398	DTA heating rate	500,501
	Poly(sulfonyl-1,4-phenyleneiminosuberoylimino-1,4-phenylene)	453	Softening point	500,501
	Poly(sulfonyl-1,4-phenyleneiminoterephthaloyl-1,4-phenylenecarbonylimino-1,4-phenylene)	590	Softening point; mechanical method	309
	Poly(thio-11-oxoundecamethyleneiminoethylene-1,4-phenyleneethyleneimino-1-oxoundecamethylene)	331	Dynamic method; low viscosity	491
	Poly(thio-3-oxotrimethyleneiminohexamethyleneimino-1-oxotrimethylene)	287-300		492
	Poly(thio-7-oxoheptamethyleneiminomethylene-1,4-phenylenemethyleneimino-1-oxoheptamethylene)	338	Dynamic method	491
	Poly(thio-5-oxopentamethyleneiminomethylene-1,4-phenylenemethyleneimino-1-oxopentamethylene)	343	Dynamic method	491
3.4.2	Poly(imines)			
	Poly(acetyliminoethylene)	~ 353	Mechanical method	549
	Poly(acetyliminotrimethylene)	~ 303	Mechanical method; low viscosity	550
	Poly(benzoyliminoethylene)	378	Mechanical method	549
	Poly(benzoyliminotrimethylene)	345	Mechanical method	550
	Poly(butyryliminoethylene)	~ 303	Mechanical method	549
	Poly(dodecanoyliminoethylene)	~ 283	Mechanical method - apparent T_g	549
	Poly[(pentadecafluorooctanoylimino)trimethylene]	298	Mechanical method	550
	Poly(heptanoyliminoethylene)	~ 283	Mechanical method - apparent T_g	549
	Poly(hexanoyliminoethylene)	~ 283	Mechanical method - apparent T_g	549
	Poly(hexanoyliminotrimethylene)	257	Mechanical method	550
	Poly(isobutyryliminoethylene)	~ 303	Mechanical method	549
	Poly(isovaleryliminoethylene)	~ 303	Mechanical method	549
	Poly(3-methoxycarbonylpropionyliminoethylene)	304	Mechanical method	551
	Poly(2-naphthoyliminoethylene)	403	Mechanical method	549
	Poly(octadecanoyliminoethylene)	~ 283	Mechanical method - apparent T_g	549
	Poly(octanoyliminoethylene)	~ 283	Mechanical method - apparent T_g	549
	Poly(propionyliminoethylene)	~ 343	Mechanical method	549
	Poly(propionyliminotrimethylene)	281	Mechanical method; low viscosity	550
	Poly(valeryliminoethylene)	~ 286	Mechanical method	549
3.4.3	Poly(ureas)			
	Poly(ureylenemethylene-1,4-phenylenemethyleneureylenedecamethylene)	328	Heating rate 1K/min	445
	Poly(ureylenemethylene-1,4-phenylenemethyleneureylenehexamethylene)	345	Heating rate 1K/min	445

	Polymer	T_g(K)	Remarks	References
3.4.3	Poly(ureas) (Cont' d.)			
	Poly(ureylenemethylene-1,4-phenylenemethyleneureyleneoctadecamethylene)	325	Heating rate 1K/min	445
	Poly(ureylenemethylene-1,4-phenylenemethyleneureyleneoctamethylene)	341	Heating rate 1K/min	445
	Poly(ureylenemethylene-1,4-phenylenemethyleneureylenetetradecamethylene)	327	Heating rate 1K/min	445
	Poly(ureylenedecamethyleneureylenetetradecamethylene)	313	Heating rate 1K/min	445
	Poly(ureylenehexamethyleneureylenedodecamethylene)	322	Heating rate 1K/min	445
	Poly(ureylenehexamethyleneureylenetetradecamethylene)	320	Heating rate 1K/min	445
	Poly(ureylenehexamethyleneureylene-1,4-phenylenemethylene-1,4-phenylene)	328	Heating rate 1K/min	445
	Poly(ureyleneoctamethyleneureylene-1,4-phenylenemethylene-1,4-phenylene)	323	Heating rate 1K/min	445
	Poly(ureylene-1,4-phenylenemethylene-1,4-phenyleneureylenedecamethylene)	319	Heating rate 1K/min	445
	Poly(ureylene-1,4-phenylenemethylene-1,4-phenyleneureylenedodecamethylene)	324	Heating rate 1K/min	445
	Poly(ureylene-1,4-phenylenemethylene-1,4-phenyleneureyleneoctadecamethylene)	321	Heating rate 1K/min	445
3.5	Poly(phosphazenes)			
	Poly(chloro-2,2,2-trifluoroethoxyphosphazene) (average structure)	213	Heating rate 20K/min; probably branched structure	552
	Poly(dichlorophosphazene)	210	DTA heating rate	553
	Poly(diethoxyphosphazene)	189	DTA heating rate	553
	Poly[bis(ethylamino)phosphazene]	303	DTA heating rate	554
	Poly[bis(2,2,2-trifluoroethoxy)phosphazene]	203		552,555,556
	Poly[bis(3-trifluoromethylphenoxy)phosphazene]	238	Heating rate 20K/min	552
	Poly[bis(1H,1H-pentadecafluorooctyloxy)phosphazene]	233	Heating rate 20K/min	552
	Poly[bis(4-fluorophenoxy)phosphazene]	259	Heating rate 20K/min	552
	Poly[bis(1H,1H-pentafluoropropoxy)phosphazene]	198,218		557
	Poly(dimethoxyphosphazene)	197	DTA heating rate	553
	Poly[bis(dimethylamino)phosphazene]	269	Dynamic mechanical method	554
	Poly(diphenoxyphosphazene)	265	DTA heating rate	553
	Poly[bis(phenylamino)phosphazene]	364	DTA heating rate	554
	Poly[bis(piperidino)phosphazene]	292		554
3.6	Poly(silanes) and Poly(silazanes)			
	Poly[(4-dimethylaminophenyl)methylsilylenetrimethylene]	267		558
	Poly[(4-dimethylaminophenyl)phenylsilylenetrimethylene]	325		558
	Poly[(methyl)phenylsilylenetrimethylene]	243	No measurement details	559
	Poly(1,1-dimethylsilazane)	191		560,561
	Poly(dimethylsilylenemethylene)	173	No measurement details	562
	Poly(dimethylsilylenetrimethylene)	203		559
	Poly(di-p-tolylsilylenetrimethylene)	311	Mechanical method	558

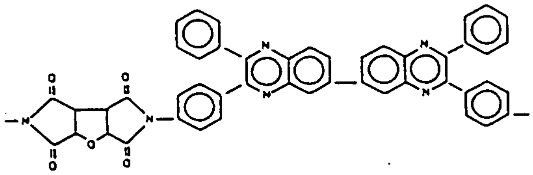
4. Main-chain Heterocyclic Polymers

4.1 Poly(furan tetracarboxylic acid diimides)

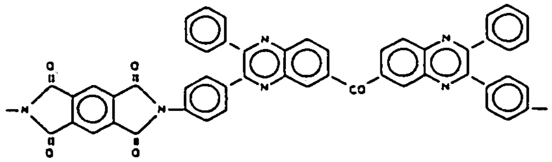
Polymer	T_g(K)	Remarks	References
Poly(4,5,6,8,9,10-hexahydro-1,3,6,8-tetraoxofuro[3,2-c:4,5-c'] dipyrrole-2,7[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diylcarbonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	528	Dynamic method	111



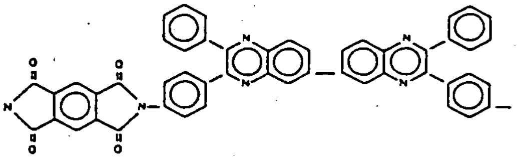
Polymer	T_g(K)	Remarks	References
Poly(4,5,6,8,9,10-hexahydro-1,3,6,8-tetraoxofuro[3,2-c:4,5-c'] dipyrrole-2,7[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	583	Dynamic method	111

	Polymer	T_g(K)	Remarks	References
4.1	Poly(furan tetracarboxylic acid diimides) (Cont' d.)			
	Poly(4,5,6,8,9,10-hexahydro-1,3,6,8-tetraoxofuro[3,2-c:4,5-c'] dipyrrole-2,7[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene) 	503	Dynamic method	111
4.2	Poly(benzoxazoles)			
	Poly(2,6-benzoxazolediyl-6,2-benzoxazolediyloctamethylene)	623	No method	112
	Poly(benzoxazole-5,2-diyloctamethylenebenzoxazole-2,5-diyliminoadipoylimino)	358	Heating rate 20K/min	113
	Poly(benzoxazole-5,2-diylhexamethylenebenzoxazole-2,5-diyliminosebacoylimino)	359	Heating rate 20K/min	113
	Poly(benzoxazole-5,2-diyloctamethylenebenzoxazole-2,5-diyliminosebacoylimino)	366	Heating rate 20K/min	113
	Poly(benzoxazole-5,2-diylhexamethylenebenzoxazole-2,5-diyliminosuberoylimino)	350	Heating rate 20K/min	113
	Poly(benzoxazole-5,2-diyl-1,3-phenylenebenzoxazole-2,5-diyliminosebacoylimino)	393	Heating rate 20K/min	113
4.3	Poly(oxadiazoles)			
	Poly(1,3,4-oxadiazolediyl-1,3-phenylene-1,3,4-oxadiazolediyl-1,4-phenylene)	551	DTA heating rate	114
	Poly(1,3,4-oxadiazolediyl-1,4-phenyleneoxy-1,4-phenylene)	513	Mechanical method	115
	Poly(1,3,4-oxadiazolediyl-1,4-phenyleneoxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxy-1,4-phenylene)	453	Mechanical method	116
	Poly(1,3,4-oxadiazolediyl-1,4-phenylene-3,3-phthalidylidene-1,4-phenylene)	653	Mechanical method	115
4.4	Poly(benzothiazinophenothiazines)			
	Poly(7,7'-(1",4"-dihydro(2,3H)benzothiazino(2',3'-b)hexahydro(1,2,3,4H)-phenothiazine] diyl)	483	Dynamic method	117
4.5	Poly(benzothiazoles)			
	Poly(2,6-benzothiazolediyl-6,2-benzothiazolediyloctamethylene)	511	No method	112
	Poly(2,6-benzothiazolediyl-6,2-benzothiazolediyl-1,3-phenylene)	768	Dynamic method	118
4.6	Poly(pyrazinoquinoxalines)			
	Poly[3,7-diphenylpyrazino(2,3-g)quinoxaline-2,8-diyl-1,3-phenylene]	638	Heating rate 20K/min	119
	Poly[3,7-diphenylpyrazino(2,3-g)quinoxaline-2,8-diyl-1,4-phenylene]	668	Heating rate 20K/min	119
	Poly[pyrazino(2,3-g)quinoxaline-2,8-diyl-1,4-phenylene]	665	Heating rate 20K/min	119
	Poly[pyrazino(2,3-g)quinoxaline-2,8-diyl-1,4-phenyleneoxy-1,4-phenylene]	626	Heating rate 20K/min	119
4.7	Poly(pyromellitimides)			
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c']dipyrrole-2,6[1H,3H]-diyl-2,7-fluorenylene)	~ 623	Heating rate 3K/min	120
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diylnonamethylene)	383	No experimental details	121
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-3-methylheptamethylene)	403	No experimental details	121
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-4,4-dimethylheptamethylene)	408	No experimental details	121
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-1,4-phenyleneoxy-1,4-phenylene)	probably > 773	Conflicting data, transitions from 523K upwards reported as T_g	119,120,122-131

	Polymer	T_g(K)	Remarks	References
4.7	Poly(pyromellitimides) (Cont' d.)			
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diylcarbonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	513	Dynamic method, heating rate 5K/min	132



	Polymer	T_g(K)	Remarks	References
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	547	Dynamic method, heating rate 5K/min	132
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	490	Dynamic method, heating rate 5K/min	132



	Polymer	T_g(K)	Remarks	References
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c'] dipyrrole-2,6[1H,3H]-diyl-1,4-phenylene-3-phenylquinoxaline-2,7-diylsulfonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	459	Dynamic method, heating rate 5K/min	132
	Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c']dipyrrole-2,6[1H,3H]-diyl-1,4-phenylenethio-1,4-phenylene)	618	Dynamic method	125
	Poly[N,N'(pp'-oxydiphenylene)pyromellitimide] see Poly(5,7-dihydro-1,3,5,7-tetraoxobenzo[1,2-c:4,5-c']-dipyrrole-2,6[1H,3H]-diyl-1,4-phenyleneoxy-1,4-phenylene)			
4.8	Poly(quinoxalines)			
	Poly(3-phenylquinoxaline-2,6-diylcarbonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	583	Dynamic method	133
	Poly(3-phenylquinoxaline-2,7-diylcarbonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	595	Values range from 531-651K	119,134,135
	Poly(3-phenylquinoxaline-2,7-diylcarbonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylene)	528	Dynamic method, heating rate 5K/min	111
	Poly(3-phenylquinoxaline-2,7-diylcarbonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	516,544	Conflicting data	119,134
	Poly(3-phenylquinoxaline-2,6-diyloxy-3-phenylquinoxaline-6,2-diyl-4,4'-biphenylene)	683	Dynamic method	136
	Poly(3-phenylquinoxaline-2,6-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenylylene)	565	Dynamic method	133
	Poly(3-phenylquinoxaline-2,7-diyloxy-3-phenylquinoxaline-7,2-diyl-1,3-phenylene)	526,543	Conflicting data possibly arising from different rate effects	119,134,137
	Poly(3-phenylquinoxaline-2,7-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	571	Dynamic method	119,134,137-139
	Poly(3-phenylquinoxaline-2,7-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylene)	527	Dynamic method	111
	Poly(3-phenylquinoxaline-2,6-diyloxy-3-phenylquinoxaline-6,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	710	Dynamic method	136
	Poly(3-phenylquinoxaline-2,6-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	516	Dynamic method	133

	Polymer	T_g(K)	Remarks	References
4.8	Poly(quinoxalines) (Cont'd.)			
	Poly(3-phenylquinoxaline-2,7-diyloxy-3-phenylquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	541		119,134,137
	Poly(3-phenylquinoxaline-2,6-diyl-3-phenylquinoxaline-6,2-diyl-4,4'-biphenylylene)	677	Dynamic method	136
	Poly(3-phenylquinoxaline-2,6-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	639-698	Dynamic methods	133
	Poly(3-phenylquinoxaline-2,7-diyl-3-phenylquinoxaline-7,2-diyl-1,3-phenylene)	593	Dynamic method	134,137
	Poly(3-phenylquinoxaline-2,7-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	range 590-638	Conflicting data; dilatometric T_g 638K	119,134,139
	Poly(3-phenylquinoxaline-2,7-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylene)	533	Dynamic method, heating rate 5K/min	111
	Poly(3-phenylquinoxaline-2,6-diyl-3-phenylquinoxaline-6,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	567	Values range from 558-693K	119,134,136,140
	Poly(3-phenylquinoxaline-2,6-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	558	Dynamic method	133
	Poly(3-phenylquinoxaline-2,7-diyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylenethio-1,4-phenylene)	561,533	Conflicting data	119,134
	Poly(3-phenylquinoxaline-2,6-diylsulfonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	543	Dynamic method	133
	Poly(3-phenylquinoxaline-2,7-diylsulfonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene)	485-618	Conflicting data	119,134,135
	Poly(3-phenylquinoxaline-2,7-diylsulfonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylene)	513	Dynamic method, heating rate 5K/min	111
	Poly(3-phenylquinoxaline-2,7-diylsulfonyl-3-phenylquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	468,563	Conflicting data	119,134
	Poly(quinoxaline-2,7-diylcarbonylquinoxaline-7,2-diyl-1,4-phenylene)	591	Heating rate 20K/min	119
	Poly(quinoxaline-2,6-diyloxyquinoxaline-6,2-diyl-4,4'-biphenylylene)	663	Dynamic method	136
	Poly(quinoxaline-2,7-diyloxyquinoxaline-7,2-diyl-1,4-phenylene)	579	Heating rate 20K/min	119
	Poly(quinoxaline-2,6-diyloxyquinoxaline-6,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	655	Dynamic method	136
	Poly(quinoxaline-2,6-diyloxyquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	543		137
	Poly(quinoxaline-2,6-diylquinoxaline-6,2-diyl-4,4'-biphenylylene)	659	Dynamic method	136,141
	Poly(quinoxaline-2,6-diylquinoxaline-6,2-diyl-1,4-phenylene)	623	Dynamic method	141
	Poly(quinoxaline-2,7-diylquinoxaline-7,2-diyl-1,4-phenylene)	649	Heating rate 20K/min	119
	Poly(quinoxaline-2,6-diylquinoxaline-6,2-diyl-1,4-phenyleneoxy-4,4'-biphenylyleneoxy-1,4-phenylene)	486	Dynamic method	141
	Poly(quinoxaline-2,6-diylquinoxaline-6,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	661,553	Dynamic method, conflicting data	136,137,141
	Poly(quinoxaline-2,7-diylquinoxaline-7,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	580		119
	Poly[quinoxaline-2,6-diylquinoxaline-6,2-diyldi(1,4-phenyleneoxy)-1,4-phenylene]	468	Dynamic method	141
	Poly[quinoxaline-2,7-diylquinoxaline-7,2-diyldi(1,4-phenyleneoxy)-1,4-phenylene]	508	Heating rate 20K/min	119
	Poly[quinoxaline-2,6-diylquinoxaline-6,2-diyltri(1,4-phenyleneoxy)-1,4-phenylene]	406	Dynamic method	141
	Poly[quinoxaline-2,7-diylquinoxaline-7,2-diyltri(1,4-phenyleneoxy)-1,4-phenylene]	489	Heating rate 20K/min	119
	Poly(quinoxaline-2,7-diylquinoxaline-7,2-diyl-p-terphenyl-4,4"-ylene)	578	Heating rate 20K/min	119
	Poly(quinoxaline-2,7-diylsulfonylquinoxaline-7,2-diyl-1,4-phenylene)	615	Heating rate 20K/min	119
4.9	Poly(benzimidazoles)			
	Poly(2,6-benzimidazolediyl-6,2-benzimidazolediyloctamethylene)	507	No experimental details	112
	Poly(2,5-benzimidazolediyl-6,2-benzimidazolediylpentamethyleneimino-4-diethylamino-1,3,5-triazinediyliminopentamethylene)	463	Heating rate 2K/min	142
	Poly(2,6-benzimidazolediyl-6,2-benzimidazolediyltrimethylene)	548	No experimental details	112
	Poly(2,5-benzimidazolediyl-5,2-benzimidazolediyl-1,3-phenylene)	703	T_g increased after storage at 773K	143

	Polymer	T_g(K)	Remarks	References
4. 9	Poly(benzimidazoles) (Cont'd.)			
	Poly(2,5-benzimidazolediyl-6,2-benzimidazolediyl-1,4-phenyleneimino-4-diphenylamino-1,3,5-triazinediylimino-1,4-phenylene)	602	Heating rate 2K/min: η_{inh} only 0.21 dl/g	142
	Poly(5,5'-bibenzimidazole-2,2'-diyl-2,2'-biphenylylene)	663	Mechanical method	144
	Poly(2,6-benzimidazolediylsulfonyl-5,2-benzimidazolediyl-1,3-phenylene)	~ 560	DTA heating rate	114
4.10	Poly(oxindoles)			
	Poly(5,7-dichloro-3,3-oxindolylidene-1,4-phenyleneoxyisophthaloyloxy-1,4-phenylene)	543		145
	Poly(3,3-oxindolylidene-1,4-phenyleneoxyisophthaloyloxy-1,4-phenylene)	529		145
4.11	Poly(oxoisoindolines)			
	Poly(N-methyl-3,3-oxoisoindolylidene-1,4-phenyleneoxyisophthaloyloxy-1,4-phenylene)	~ 558	Transition indistinct	145
	Poly(N-methyl-3,3-oxoisoindolylidene-1,4-phenyleneoxyterephthaloyloxy-1,4-phenylene)	~ 555	Transition indistinct	145
	Poly(3,3-oxoisoindolylidene-1,4-phenyleneoxyisophthaloyloxy-1,4-phenylene)	598		145
	Poly(3,3-oxoisoindolylidene-1,4-phenyleneoxyterephthaloyloxy-1,4-phenylene)	600		145
4.12	Poly(dioxoisoindolines)			
	Poly(1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylene)	~ 638	Dynamic method	124,125,146,147
	Poly(1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenedecafluoropentamethylene-1,3-phenylene)	533-543	Softening point; viscosity only 0.11 dl/g	148
	Poly(1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylene)	~ 393	Sample hygroscopic	149
	Poly(1,3-dioxoisoindoline-2,5-diylcarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	> 469	Heating rate 32K/min	124,125,150
	Poly(1,3-dioxoisoindoline-2,5-diylcarbonylimino-1,4-phenyleneiminocarbonyl-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene)	641	Dynamic method	151
	Poly(1,3-dioxoisoindoline-2,5-diylhexafluorotrimethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenedecafluoropentamethylene-1,3-phenylene)	371	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diylhexafluorotrimethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylene)	418		148
	Poly(1,3-dioxoisoindoline-2,5-diyloctafluorotetramethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenedecafluoropentamethylene-1,3-phenylene)	417	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diyloctafluorotetramethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylene)	432	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diyltetradecafluoroheptamethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenedecafluoropentamethylene-1,3-phenylene)	385	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diyltetradecafluoroheptamethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylene)	406	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diylhexafluorotrimethylene-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenemethylene-1,4-phenylene)	498	Heating rate 32K/min	152
	Poly(1,3-dioxoisoindoline-2,5-diyldodecafluorohexamethylene-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	458	Heating rate 32K/min	153
	Poly(1,3-dioxoisoindoline-2,5-diylhexafluorotrimethylene-1,3-dioxoisoindoline-5,2-diyl-1,3-phenyleneoxy-1,3-phenylene)	451	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diylhexafluorotrimethylene-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	488		148
	Poly(1,3-dioxoisoindoline-2,5-diylhexadecafluorooctamethylene-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	457	Heating rate 32K/min; highly crystalline	152
	Poly(1,3-dioxoisoindoline-2,5-diyloctafluorotetramethylene-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	485	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diyltetradecafluoroheptamethylene-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	460	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diylhexafluorotrimethylene-1,3-dioxoisoindoline 5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene)	533	Heating rate 32K/min	154
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenedecafluoropentamethylene-1,3-phenylene)	393		148
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenylenehexafluorotrimethylene-1,3-phenylene)	457	Heating rate 32K/min	148

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	Polymer	T_g(K)	Remarks	References
4.12	Poly(dioxoisoindolines) (Cont' d.)			
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenyleneimino-4-dimethylamino-1,3,5-triazinediylimino-1,3-phenylene)	567	Heating rate 2K/min	142
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenyleneimino-4-diphenylamino-1,3,5-triazinediylimino-1,3-phenylene)	563	Heating rate 2K/min	142
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenyleneimino-4-phenyl-1,3,5-triazinediylimino-1,3-phenylene)	565	Heating rate 2K/min	142
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenyleneimino-1,3,5-triazinediylimino-1,3-phenylene)	563	Heating rate 2K/min	142
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,3-phenyleneoxy-1,3-phenylene)	480	Heating rate 32K/min	148
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,4-phenyleneoxy-1,4-phenylene)	523	Heating rate 2K/min	129
	Poly(1,3-dioxoisoindoline-2,5-diyloxy-1,3-dioxoisoindoline-5,2-diyl-1,4-phenylene-4-phenyl-1,3,5-triazinediyl-1,4-phenylene)	628	Heating rate 2K/min	142
	Poly(1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonylimino-4,4'-biphenylyleneiminocarbonyl)	643	Dynamic method	151
	Poly(1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonylimino-1,3-phenyleneiminocarbonyl)	584	Dynamic method	151
	Poly(1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyl)	597	Dynamic method	151
	Poly(1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonylimino-1,4-phenyleneoxy-1,4-phenyleneiminocarbonyl)	583	Dynamic method	151
	Poly(1,3-dioxoisoindoline-5,2-diyl-1,4-phenylenesulfonyl-1,4-phenylene-1,3-dioxoisoindoline-2,5-diylcarbonylimino-1,4-phenylenesulfonyl-1,4-phenyleneiminocarbonyl)	580	Dynamic method	151
4.13	Poly(triazines)			
	Poly[(4-H-octafluorobutyl)-1,3,5-triazinediyltrimethylene]	253-255	No measurement details	155
	Poly(pentafluoroethyl-1,3,5-triazinediyltrimethylene)	253-255	No measurement details	155
	Poly(2-H-tetrafluoroethyl-1,3,5-triazinediyltrimethylene)	253-255	No measurement details	155
	Poly(heptafluoropropyl-1,3,5-triazinediyltrimethylene)	253-255	No measurement details	155
	Poly[perfluoro(propyl-1,3,5-triazinediylhexamethylene)]	261	DTA heating rate	156
	Poly(6-phenyl-1,3,5-triazinediylphenylimino-1,3,5-triazinediylphenylimino)	541-552	DTA heating rate	114
	Poly(6-phenyl-1,2,4-triazine-5,3-diyl-2,6-pyridinediyl-6-phenyl-1,2,4-triazine-3,5-diyl-1,4-phenylene)	533	Dynamic method; different structural isomers may be present	157
	Poly(6-phenyl-1,2,4-triazine-5,3-diyl-2,6-pyridinediyl-6-phenyl-1,2,4-triazine-3,5-diyl-1,4-phenylenemethylene-1,4-phenylene)	478	Dynamic method; different structural isomers may be present	157
	Poly(6-phenyl-1,2,4-triazine-5,3-diyl-2,6-pyridinediyl-6-phenyl-1,2,4-triazine-3,5-diyl-1,4-phenyleneoxy-1,4-phenylene)	488	Dynamic method; different structural isomers may be present	157,158
	Poly(1,2,4-triazine-5,3-diyl-2,6-pyridinediyl-1,2,4-triazine-3,6-diyl-1,4-phenyleneoxy-1,4-phenylene)	496	Heating rate 20K/min	159
4.14	Poly(pyridazines)			
	Poly(3,6-pyridazinediyloxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxy)	453	Mechanical method	116
4.15	Poly(piperazines)			
	Poly(2,5-dimethyl-1,4-piperazinediylcarbonyloxyneopentylenesulfonylneopentyleneoxycarbonyl)	358		160
	Poly(2,5-dimethyl-1,4-piperazinediylcarbonyloxyneopentylenethioneopentyleneoxycarbonyl)	313		160
	Poly(1,4-piperazinediyladipoyl)	399	No experimental details	161,162
	Poly(1,4-piperazinediylcarbonyl-2,2'-biphenylylenecarbonyl)	466	Mechanical method, heating rate 1K/min; low viscosity	78,161
		333		163
	Poly(1,4-piperazinediylcarbonyloxyethyleneoxycarbonyl)	343		160
	Poly(1,4-piperazinediylcarbonyloxyneopentyleneoxycarbonyl)	386	DTA heating rate	164
	Poly(1,4-piperazinediylcarbonyloxy-9-oxabicyclo[3,3,1]nonan-2,6-yleneoxycarbonyl)			

	Polymer	T_g(K)	Remarks	References
4.15	Poly(piperazines) (Cont'd.)			
	Poly(1,4-piperazinediylcarbonyl-1,4-phenylene-2,2-butylidene-1,4-phenylenecarbonyl)	492-505		165
	Poly(1,4-piperazinediylisophthaloyl)	465	Mechanical method, heating rate 1K/min	78,161
	Poly(1,4-piperazinediyl-1-oxotrimethylenefluoren-9-ylidene-3-oxotrimethylene)	418	Mechanical method, heating rate 1K/min	78,161
	Poly(1,4-piperazinediylsebacoyl)	~355	Rather ill-defined transition	161,166-168
4.16	Poly(pyridines)			
	Poly(2,3,5-trifluoropyridinediyloxy-2,2,3,3,4,4-hexafluoropentamethyleneoxy)	260	Polymer structure may contain o-linkages	169
	Poly(2,5-pyridinediylcarbonyliminohexamethyleneiminocarbonyl)	322		170
4.17	Poly(piperidines)			
	Poly(2,6-dioxopiperidine-1,4-diyltrimethylene)	363	Heating rate 10K/min	172
4.18	Poly(triazoles)			
	Poly(4-phenyl-1,2,4-triazolediyl-1,3-phenyleneiminoterephthaloylimino-1,3-phenylene)	623	DTA heating rate	173
	Poly(4-phenyl-1,2,4-triazolediyl-1,3-phenylene-4-phenyl-1,2,4-triazolediyl-1,4-phenylene)	538		174
4.19	Poly(pyrazoles)			
	Poly(1,3-pyrazolediyl-1,3-phenylene-3,1-pyrazolediylhexamethylene)	343	DTA heating rate; viscosity low	175
	Poly(1,3-pyrazolediyl-1,4-phenylene-3,1-pyrazolediylhexamethylene)	353	DTA heating rate; high crystallinity	175
	Poly(1,3-pyrazolediyl-1,3-phenylene-3,1-pyrazolediyl-1,4-phenylene)	353	DTA heating rate; high crystallinity	175
	Poly(1,3-pyrazolediyl-1,4-phenylene-3,1-pyrazolediyl-1,4-phenylene)	373	DTA heating rate; high crystallinity	175
4.20	Poly(pyrrolidines)			
	Poly(2,5-dioxo-1,3-pyrrolidinediylethylene)	408	Heating rate 20K/min	176,177
4.21	Poly(carboranes)			
	Poly($C_2B_5H_5$-carboranylenedimethylsilyleneoxydimethylsilylene)	277,211	Conflicting data	178,179
	Poly($C_2B_5H_5$-carboranylenedi(dimethylsilyleneoxy)dimethylsilylene)	< 188	Dynamic method	180
	Poly($C_2B_{10}H_{10}$-carboranylenedimethylsilyleneoxydimethylsilylene)	298	Mechanical method	181
	Poly($C_2B_{10}H_{10}$-carboranylenedi(dimethylsilyleneoxy)dimethylsilylene)	239		180-182
	Poly($C_2B_{10}H_{10}$-carboranylenetri(dimethylsilyleneoxy)dimethylsilylene)	213	Mechanical method	180-182
4.22	Poly(fluoresceins)			
	Poly(fluorescein-3',6'-diyloxyisophthaloyloxy)	549		183
4.23	Poly(oxabicyclononanes)			
	Poly[9-oxabicyclo(3,3,1)nonane-2,6-diyloxycarbonylimino-1,4-cyclohexylenemethylene-1,4-cyclohexyleneiminocarbonyloxy]			
	53% trans,trans	494	DTA heating rate	164
	70% trans,trans	502		
	Poly[9-oxabicyclo(3,3,1)nonane-2,6-diyloxycarbonylimino-1,4-phenylenemethylene-1,4-phenyleneiminocarbonyloxy]	473		164
	Poly[9-oxabicyclo(3,3,1)nonane-2,6-diyloxycarbonyloxy-1,4-phenyleneisopropylidene-1,4-phenyleneoxycarbonyloxy]	467	DTA heating rate	164
4.24	Poly(dibenzofurans)			
	Poly(3,6-dibenzofurandiylsulfonyl)	633		184
	Poly(3,6-dibenzofurandiylsulfonyl-1,4-phenyleneoxy-1,4-phenylenesulfonyl)	563		184
4.25	Poly(phthalides)			
	Poly(3,3-phthalidylidene-1,4-phenyleneoxy-5-tert-butylisophthaloyloxy-1,4-phenylene)	552		145
	Poly(3,3-phthalidylidene-1,4-phenyleneoxycarbonyloxy-1,4-phenylene)	513,538	Conflicting data	145,185

	Polymer	T_g(K)	Remarks	References
4.25	Poly(phthalides) (Cont' d.)			
	Poly(3,3-phthalidylidene-1,4-phenyleneoxy-5-chloroisophthaloyloxy-1,4-phenylene)	586		145
	Poly(3,3-phthalidylidene-1,4-phenyleneoxyisophthaloyloxy-1,4-phenylene)	591		145
4.26	Poly(acetals)			
	Poly(2-ethyl-1,3-dioxa-4,6-cyclohexylenemethylene)	345		1
	Poly(2-isopropyl-1,3-dioxa-4,6-cyclohexylenemethylene)	329		1
	Poly(2-methyl-1,3-dioxa-4,6-cyclohexylenemethylene)	355		1
	Poly(1,3-dioxa-4,6-cyclohexylenemethylene)	378		1,187
	Poly(1,3-dioxa-2-propyl-4,6-cyclohexylenemethylene)	322		1,188
	Poly(vinyl acetal) see Poly(2-methyl-1,3-dioxa-4,6-cyclohexylenemethylene)			
	Poly(vinyl butyral) see Poly(1,3-dioxa-2-propyl-4,6-cyclohexylenemethylene)			
4.27	Poly(anhydrides)			
	Poly(methacrylic anhydride)	432	Vicat softening point	186
4.28	Carbohydrates			
	Amylose triacetate	440	Heating rate 5-10K/min	189
	Amylose tributyrate	365	Heating rate 5-10K/min	189
	Amylose hexanoate (2.9)	315	Heating rate 5-10K/min	189
	Amylose tripropionate	406	Heating rate 5-10K/min	189
	Amylose valerate (2.8)	330	Heating rate 5-10K/min	189
	Cellulose	range 243-433	Conflicting data	190-200
	Cellulose triacetate	range 322-751	Conflicting data; depend on acetate and water content and degree of crystallinity	1,21,93,143,188, 191,197,201-214
	Cellulose tributyrate	338		1,206,215
	Cellulose tridecanoate	321		215
	Cellulose triheptanoate	320		215
	Cellulose trihexanoate	237		215
	Cellulose nitrate	326,339	Conflicting data	18,21,188,201,216,217
	Cellulose tripropionate	400		215
	Cellulose trivalerate	338		215
	Cyanoethyl cellulose	453	Dynamic method	197
	Ethyl cellulose	316		1,201
	Methyl cellulose	423	Dynamic method	197
	Triphenylmethyl cellulose	426	Dynamic method	197

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6 | Performance of Silane Coupling Agents

6.1. General

The need for coupling agents was recognized in 1940 when glass fibers were first used as reinforcements in organic resins. Specific strength-to-weight ratios of dry glass–resin composites were very favorable, but the laminates lost much of their strength during prolonged exposure to moisture. Because unsaturated polyester resins were the most common organic matrix material, various unsaturated compounds of silicon and other elements were tested as coupling agents. Only unsaturated silanes and methacrylatochrome complexes (DuPont Volan®) have reached commercial importance.

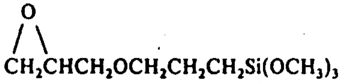
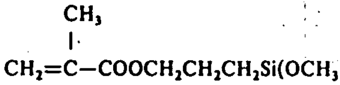
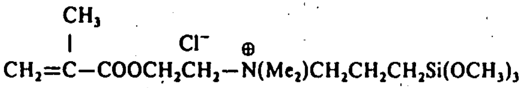
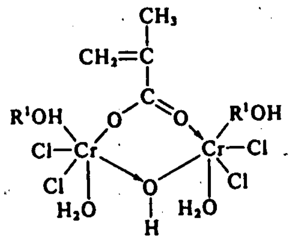
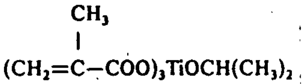
As fiberglass reinforcements were used with other resins, new coupling agents were introduced with specific reactivity for these resins. In general, the best silane coupling agents are those where the organofunctional group on silicon has maximum reactivity with the particular thermosetting resin during cure. Silane coupling agents were also developed for reinforced elastomers and thermoplastic resins.

The same silane coupling agents that were used on glass were also effective on particulate minerals in filled polymers (Chapter 7), and as primers on metal or ceramic surfaces for adhesion of sealants, paints, and adhesives. In some cases, silane coupling agents even promoted adhesion of an organic polymer to another organic polymer. Representative commercial silanes of Table 6.1 are discussed below in their applications with various types of polymers (Figure 6.1).

6.2. Unsaturated Polyesters

Fiberglass manufacturers apply a silane-containing size to fiberglass immediately as the fibers are pulled from the melt. Compositions of these

Table 6.1. Representative Commercial Coupling Agents

	Organofunctional group	Chemical structure
A.	Vinyl	$CH_2{=}CHSi(OCH_3)_3$
B.	Chloropropyl	$ClCH_2CH_2CH_2Si(OCH_3)_3$
C.	Epoxy	 $\overbrace{CH_2CH}^{O}CH_2OCH_2CH_2CH_2Si(OCH_3)_3$
D.	Methacrylate	 $CH_2{=}\overset{CH_3}{\overset{\vert}{C}}{-}COOCH_2CH_2CH_2Si(OCH_3)_3$
E.	Primary amine	$H_2NCH_2CH_2CH_2Si(OC_2H_5)_3$
F.	Diamine	$H_2NCH_2CH_2NHCH_2CH_2CH_2Si(OCH_3)_3$
G.	Mercapto	$HSCH_2CH_2CH_2Si(OCH_3)_3$
H.	Cationic styryl	$CH_2{=}CHC_6H_4CH_2NHCH_2CH_2NH(CH_2)_3Si(OCH_3)_3{\cdot}HCl$
I.	Cationic methacrylate	 $CH_2{=}\overset{CH_3}{\overset{\vert}{C}}{-}COOCH_2CH_2{-}\overset{Cl^- \quad \oplus}{N}(Me_2)CH_2CH_2CH_2Si(OCH_3)_3$
J.	Chrome complex	
K.	Titanate	 $(CH_2{=}\overset{CH_3}{\overset{\vert}{C}}{-}COO)_3TiOCH(CH_3)_2$
L.	Cross-linker	$(CH_3O)_3SiCH_2CH_2Si(OCH_3)_3$
M.	Mixed silanes	$C_6H_5Si(OCH_3)_3 + F$
N.	Formulated	Melamine resin + C

sizes are proprietary and are merely described as "compatible" with specific resins. Adhesion promotion by silanes is modified with other materials to provide fiber protection, lubrication, antistatic properties, strand integrity, and wet-out by resins.

The performance of coupling agents may be tested by treating heat-cleaned glass cloth with aqueous dispersions of individual coupling agents. Typical polyester laminates prepared with 12 plies of glass cloth treated with 0.5% aqueous coupling agent are described in Table 6.2. The methacrylato-chrome complete was a favorite for years, and the typical green color imparted to laminates was associated with high-quality polyester laminates.

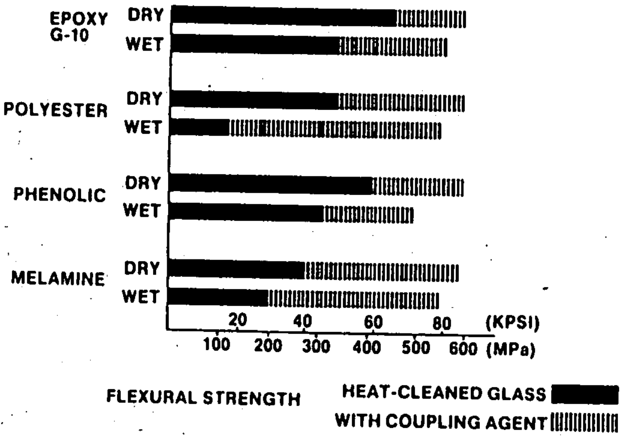


Figure 6.1. Effect of coupling agents on flexural strengths of glass cloth-reinforced thermosetting resins.

The methacrylate ester silane is preferred with most general purpose polyesters. The cationic vinylbenzyl silane gives best performance with vinyl resins (acrylic-modified epoxies). It also was the one silane uniquely effective in bonding UV-cured vinyl resins to quartz fibers used in fiber optics.[1] It is also recommended in anaerobic curing resins.

Over 100 unsaturated organosilicon compounds were compared as coupling agents on glass in polyester laminates.[2] A number of these materials were very effective as coupling agents, but showed no advantage over the silanes of Table 6.2.

Table 6.2. Fiberglass-Reinforced Polyester Composites

Couplimg agent on glass		Flexural strength of composite (MPa)	
Function	Ref. Table 6.1	Dry	After 2-hr water boil
None		386	234
BJY finish[a]		441	386
Chrome complex	J	503	428
Vinyl silane	A	462	414
Methacrylate silane	D	620	586
Cationic methacrylate silane	I	620	566
Cationic vinylbenzyl silane	H	634	566

[a] Equimolar $CH_2{=}CHSiCl_3$ and $CH_2{=}CCl{-}CH_2OH$.

Rather than look for new organofunctional silanes for coupling with polyester resins, efforts in recent years have been aimed toward more effective application of presently available materials.

The effect of pH of aqueous silane baths was shown to be most important with the cationic silanes. Optimum pH for application of coupling agent to glass or silica was at the isoelectric point of the mineral surface (see Figure 4.6).

Neutral organofunctional silanes benefit from addition of an amine catalyst to aid in condensation of silanols at the interface (Table 5.3). An amino-organofunctional silane may be used in admixture with the methacrylate ester-functional silane. The amine acts as catalyst for bonding of silanols to glass and then deposits as a mixed siloxane on the surface. Single silanes were compared with mixed silanes as treatment on glass microbeads in polyester catings (Table 6.3). The diamine-functional silane (F of Table 2.2) was effective as a catalyst as shown by initial properties of the castings, but it caused a decrease in strength retention after a 24-hr water boil. Unreacted amine functions apparently are hydrophilic enough to favor entrance of water to the interphase region. The vinylbenzyl cationic silane H also showed catalytic activity in improving initial bonding of coupling agents to glass, but then participated in polymer cure to provide significant improvement in resistance to a 24-hr water boil.

Flexible polymers with polymerizable plasticizers may be treated like unsaturated polyesters. Reactive unsaturated silanes may be used as primers or as additives to provide water-resistant adhesion to mineral surfaces. Silanes D and H are recommended in PVC plastisols having polymerizable plasticizers. Clear ethylene-vinylacetate (EVA) or ethylene-methacrylate (EMA) copolymers may be cross-linked with small proportions of peroxides to obtain clear, noncreeping encapsulants for solar cells. A mixture of an amine with silane D was very effective as a primer or as an additive for bonding to various surfaces[3] with cross-linkable EVA (Table 6.4).

Thin films of unsaturated polyester resin, cured on primed glass or metal coupons (cf. Section 1.3) were used to screen coupling agents of Table 6.1 for relative effectiveness in promoting water-resistant bonds (Table 6.5). Primers were rated according to the improvement in time to failure compared to unprimed controls:

− = *not recommended*, no significant improvement
+ = *fair to good*, 10× to 100× improvement
++ = *very good*, 100-fold or more improvement.

Table 6.3. Glass Microbead[a]-Filled Polyester Castings

Coupling agent on glass		Flexural strength of castings, MPa		
Nature	Ref. Table 6.1	Dry	2-hr boil	24-hr boil
Untreated	—	72	54	33
Vinyl silane	A	82	76	41
Methacrylate silane	D	145	123	67
Vinylbenzyl silane	H	154	118	62
9/1 mix	D/F	150	131	55
9/1 mix	D/H	155	135	82

[a] Potters® 3000 microbeads, 30-50μ.

Table 6.4. Adhesion of Cross-Linkable EVA to Various Surfaces (cured for 20 min at 150°C)

	Peel strength after 4 days in water, N/cm				
Primer system	Glass	Copper	Aluminum	Phenolic	Tedlar®
Unprimed control	Nil	Nil	1.0	3.9	Nil
Prehydrolyzed D	[a]	10.0	1.0	3.9	[a]
1% BDMA in D	[a]	[a]	[a]	[a]	[a]
Primer milled into EVA					
Prehydrolyzed D	15.6	3.9	7.8	11.7	3.9
9/1 D/E	19.6	[a]	[a]	[a]	[a]
1% BDMA in D	[a]	[a]	[a]	[a]	[a]

[a] Cohesive failure in EVA at about 35 N/cm.

Table 6.5. Coupling Agents for Unsaturated Polyesters (screening tests)[a] (catalyzed CoResyn® 5500 cured 30 min at 130°C)

	Retention of adhesion on			
Primer on surface	Glass	Aluminum	C.R. steel	Titanium
J	+	+	+	−
K	+	+	−	+
APG-2[b]	+	−	−	−
D	++	++	+	+
H	++	++	++	++

[a] (−) not recommended; (+) fair-good; (++) very good.
[b] APG-2 = Caveco-Mod® alumino-zirconate, Cavedon Chemical Co.

6.3. UV-Curable Coatings

Ultraviolet-light-curable coatings are generally solvent-free liquid oligomers with multiple acrylic functionalities along with a UV absorber to act as initiator. Methacrylates are not initiated by UV in such systems, but methacrylates will copolymerize with activated acrylic monomers. Silane D (Table 6.1) is generally useful as an adhesion-promoting additive or primer for UV-cured acrylic oligomers. A commercial acrylic-modified urethane, Lightweld® 415 (supplied by Dyman Co., Torrington, CT) was tested as thin films cured on various primed surfaces. Silane D proved to be an effective adhesion promoter, but it was improved greatly by mixing with crosslinker L (Table 6.6).

UV-light-cured cyclo-aliphatic epoxide formulations are available under the trade names Cyracures® from Union Carbide Corp. (Danbury, CT). These materials use arylsulfonium salts as initiators which are stable under normal conditions but release cationic initiators (BF_3 or PF_5) when exposed to UV light.[4] In the presence of the generated cationic species, very rapid polymerization takes place. Thin films of a fomulation comprising 9 parts Cyracure® Resin UVR-610 and 4 parts Cyracure® Initiator UV16990 on glass, aluminum, and steel were passed under twin UV lamps (intensity 30.92 MW/cm^2) through a 61.25-cm path at a rate of 3 meters/min. Films were tackfree but were generally given an after cure of 1 hr at 100°C. Of the standard silanes tested, all aminofunctional silanes were completely unsuited since they inhibited the cure. Of the other silanes, several showed significant improvement in adhesion to glass. Unprimed adhesion to aluminum was fairly good and further improved by adding 1% silane to the formulation. None of the films retain adhesion very well to glass or steel in 70°C water (Table 6.7). Fluoride ions derived from the initiator may be detrimental for bonding to glass and steel while they may benefit adhesion to aluminum by producing an insoluble aluminum fluoride surface.

Table 6.6. Adhesion of UV-Curable Acrylic Coating to Primed Surfaces

Primer on surfaces	Glass		C.R. Steel		Stainless steel		Aluminum		Polyester film
	Dry	Wet[a]	Dry	Wet	Dry	Wet	Dry	Wet	Dry (90° peel)
None	Good	Nil	Fair	Nil	Good	Nil	Fair	Nil	Poor
Silane D	Exc.[b]	Fair	Exc.	Poor	Exc.	Exc.	Exc.	Exc.	Fair (7.5 N/cm)
1/1 Mix D/L	Exc.	Exc.	Exc.	Exc.	Exc.	Exc.	Exc.	Exc.	Fair (7.5 N/cm)

[a] wet = after 1 day in 70°C water.
[b] exc. = could not be peeled, 100% cohesive failure.

6.4. Epoxy Resins

6.4.1. General

Epoxy resins are a broad class of resins that cure through some reaction of oxirane functionality. The basic resin may be a family of bis-phenol-A glycidyl ether oligomers, novalac glycidyl ethers, aliphatic glycidyl ethers, hydantoin glycidyl ethers, cycloaliphatic epoxides, and others, Brominated modifications of these may be used in fire-retardant composites. Various curing agents used with these resins include polyfunctional aliphatic amines, aliphatic amine polyamides, aromatic amines, cyclic polyacid anhydrides, dicyandiamide, BF_3-amine complexes, and others.

A large number of organofunctional silanes are effective with epoxy resins,[2] but certain generalizations can be made in selecting the optimum silane for a given system. The coupling agent should have a reactivity at least comparable to that of the epoxy resin with the particular curing system used. The glycidoxypropyl silane (C of Table 6.1) is an obvious choice in any given glycidylfunctional epoxy resin.

Room-temperature-curing epoxies get maximum performance by addition of primary aminofunctional silanes (E and F). These same silanes should be avoided with anhydride-cured epoxies. A large proportion of the primary amine function is consumed in forming cyclic imides with the curing agent.[5] The mechanism of coupling agent reaction is not always

Table 6.7. Adhesion of UV-Curable Epoxy on Unprimed Surfaces, UV + 1 hr (100°C post-cure)

1% additive to formulation	Time for loss of adhesion in 70°C water		
	Glass	Aluminum	C.R. steel
None	15 min	6 hr	30 min
Silane D	30 min	[a]	1 hr
Silane C	2 hr	[a]	1 hr
Silane B	2 hr	[a]	1 hr
Silane A	2 hr	[a]	2 hr
Silane L	6 hr	[a]	1 hr

[a] No failure in 4 days in 70°C water.

obvious. Silane B with a chloropropyl functionality is a creditable coupling agent with high-temperature-cured epoxies.[6] Under these conditions, the chloropropyl group can react with aromatic amines or with carboxyl groups (in the presence of benzyldimethyl-amine catalyst).[7]

6.4.2. Thin Film Tests

Coupling agents were screened as primers for typical epoxy formulations by comparing the time to failure of thin films of polymer cured on primed microscope slides and soaked in water until interfacial failure could be induced by prying with a razor blade.

Fisher brand 12-550-11 precleaned microscope slides were used directly from the box. Metal coupons were scrubbed with Scotchbrite(TM) pads or with kitchen cleanser on a moistened cloth. Metal surfaces were considered to be clean if water spread evenly.

Primers were prepared by diluting commercial silanes to about 20% active material in isopropanol. Neutral silanes were catalyzed by adding 1% diaminofunctional silane (F) based on total silane. A 2% solution of aluminum secondary butoxide[9] (Chattem Chemical) in toluene was compared with silane primers for some epoxides. Kimwipes(TM) tissues paper (Kimberly Clark) was moistened with primers and wiped on the microscope slides or metal coupons to be tested. After 15 min at room temperature, an epoxy formulation was troweled on the primed surface with a spatula to give films about 0.2-0.5 mm thick. After curing the epoxy, as indicated, the composite was placed in water (70°C or boiling) and tested periodically by attempting to loosen the film with a razor blade. Primers were rated according to the length of time the film retained adhesion. In parallel tests, an epoxy film on silane-primed aluminum showed first signs of failure after 4 hr in 70°C water. The same system in a lap shear test showed only a trace of interfacial failure after 150 days in 70°C water at a lap shear strength of 5000 psi (34.5 MPa).

Ratings of silane primers were:

−	*Not recommended,* although performance may have been better than a control;
+	*Good,* significantly better than the control, as much as 100-fold increase in time of failure;
++	*Very good,* up to 1000-fold improvement over the control; and
+++	Outstanding, best of the series.

Table 6.8. Silane Primers for Epoxies on Glass

Primer	DETA Cure: RT	TEPA 80°C	DMP-30 RT	Versamid RT	Nadic-Me Anh. 150°C	*m*-PDA 150°C	DADPS 180°C
F	−	−	−	+	−	+	−
D	++	−	+	−	+	++	+
H	+	++	+++	+	+	++	++
C	+++	++	+	++	+	++	+
G	++	+	−	+	−	+	+
B	++	+++	+	+	+	+++	+++
E	−	−	−	−	−	−	−
M	++	+	++	−	+	++	+
N	++	++	++	+++	+++	−	−
Al(s-BuO)$_3$	+					−	−
Limits of H_2O test	← 7 days at 70°C →				14 days at 70°C	7 days boil	

Ratings: −, not recommended; +, good; ++, very good; +++, best of series.

When several primers showed no failure to the limits of the test they were all rated ++.

A technical grade of diglycidyl ether of bisphenol A, DER 331 (Dow Chemical Co.), epoxy equivalent weight 177–188, was used in all homemade formulations. Curing agents included DEH-24 (Dow Chemical Co.) triethylenetetramine (TETA) used at 13 parts per 100 parts of resin (phr), DEH-26 (Dow Chemical Co.) tetraethylene pentamine (TEPA) used at 14 phr, Versamid-125 (General Mills) amine polyamide used at 100 phr, DMP-30 (Rohm and Haas) trisdimethylaminophenol used at 10 phr, *m*-phenylenediamine (*m*PDA) used at 14 phr, diaminodiphenylsulfone (DADPS) used at 33 phr, and Nadic methylanhydride (Applied Chemical) used at 100 phr.

A few typical epoxy formulations with standard curing agents were tested on glass microscope slides as indicated in Table 6.8. Simple aminofunctional silanes, which are commonly used as adhesion promoters, are not recommended with most of these formulations. A modified amine functional silane (H) or a mixture of $PhSi(OMe)_3$, with an aminofunctional silane (M) is greatly superior for most of the epoxies. Surprisingly good results were obtained with chloropropyl silane (B) and a silane-modified melamine resin (N).

Some of the silanes were compared as primers and as additives to a commercial room-temperature curing epoxy formulation, Magnabond 6388-3 (Magnolia Plastics, Chandler, GA) on glass (Table 6.9). Aminosilanes F and H were much more effective as additives than as primers. The mixed silane M was very effective as a primer but not as 1% additive. The major component [$PhSi(OMe)_3$] in M is not an adhesion promoter unless it is cohydrolyzed with a reactive silane to form mixed siloxane oligomers with reactive sites for bonding.

It has been disclosed that performance of any silane adhesion promoter can be improved by adding a cross-linking silane to it.[10] The compound bis-trimethoxysilylethane, L, was tested with silanes F and C in primers for room-temperature curing epoxies (Table 6.10). With this cross-linker, it was possible to formulate primers that provided bonds that resisted 70°C water for over 1 week. Silane C required less cross-linker than did silane F to provide water-resistant bonds to glass. The cross-linker itself is a creditable adhesion promoter in these systems, although it is not effective alone with some polymers.

Mixtures of cross-linker with diamine-functional silane, F, were used as sole curing agents for epoxy adhesives bonded to glass and to steel. Silane F itself provided better adhesion than the simple aliphatic amine $C_8H_{17}NHCH_2CH_2NH_2$ of comparable functionality and molecular weight. Water resistance of bonds was further improved significantly by adding cross-linker to F curing agent (Table 6.11).

Table 6.9. Comparison of Silane Primers to Additives (Magnabond 6388-3 to glass)

Silane	Primer	1% additive
F	+	+++
H	+	++
G	+	−
M	+++	−
N	+	+

Table 6.10. Room-Temperature-Cured Epoxy Films on Glass (hours in 70°C water to adhesion loss)

Primer on glass	Polyamide	DMP-30	DEH-24
None	<1	<1	<1
F	1	1	1
9/1 F/L	2	3	1
8/2 F/L	2	3	1
6/4 F/L	3	3	2
1/1 F/L	4	4	8
1/9 F/L	[a]	[a]	[a]
L	[a]	6	[a]
C	[a]	8	[a]
9/1 C/L	[a]	36	[a]
8/2 C/L	[a]	[a]	[a]

[a] No failure after 1 week in 70°C water.

Table 6.11. Aminosilane Mixtures as Curing Agents for Adhesion to Steel and to Glass (stoichiometric mix with DER-667 cured 4 hr at 70°C)

Composition of curing agent	Adhesion to coupons in 70°C water	
	CR steel	Glass
Aliphatic diamine (no Si)	<4 hr	2 hr
F	2 days	1 day
9/1 F/L	3 days	2 days
1/1 F/L	5 days	2 days
1/9 F/L	>5 days	>5 days

6.4.3. Printed Circuit Boards

The printed circuit industry is based largely on high-quality glass-reinforced epoxy (copper-clad) laminates with initial insulation resistance of over 10^7 megaohms. Processing into circuit boards involves drilling, degreasing and drying, metallizing and copper-plating (of holes), rinses, stripping, etching, immersion in molten tin, and reflow followed by final cleaning and testing. For testing, the printed boards are subjected to 10-day humidity cycling per method 106 of MIL-STD-202. Twice daily, the temperature is raised to 65°C at a humidity of 90–98%. After completion of the conditioning, each specimen is removed separately and insulation resistance is measured within 1 min or removal. Properly prepared double-sided boards are several orders of magnitude better than the required 500-megaohm insulation resistance (MIL-P-55110) on adjoining surfaces at specified distances.

During recent years, the density of holes in commercial boards has increased dramatically. Spacing between holes has decreased to the point where 2.5 mm between centers of holes is common. With 1-mm-diam holes, the distance between hole walls is only 1.5 mm (Figure 6.2). Failure occurs when acids or other conductive materials migrate along glass fiber bundles to form a conductive path between adjacent holes. The probability of early failure increases as the density of holes on the board increases.

Vaughan and McPherson[11] reported on the effect of adverse conditions on the resin–glass interface in G-10 epoxy composites. Laminates prepared with various coupling agents on glass were tested for mechanical properties after boiling in water for up to 200 hr. Retention of flexural strength (Figure 6.3) was better with silane coupling agents than with the chrome complex (J). Among the silanes, the cationic styrylfunctional silane (H) was outstanding.

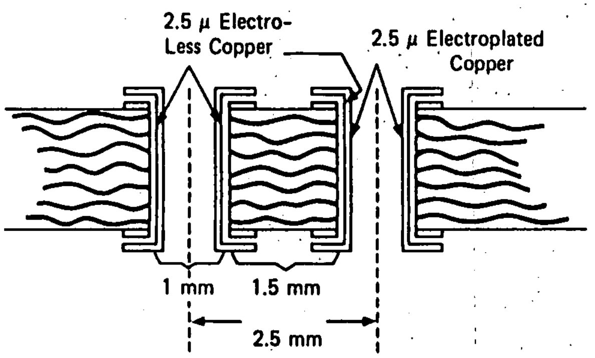


Figure 6.2. Double-sided boards with plated-through holes.

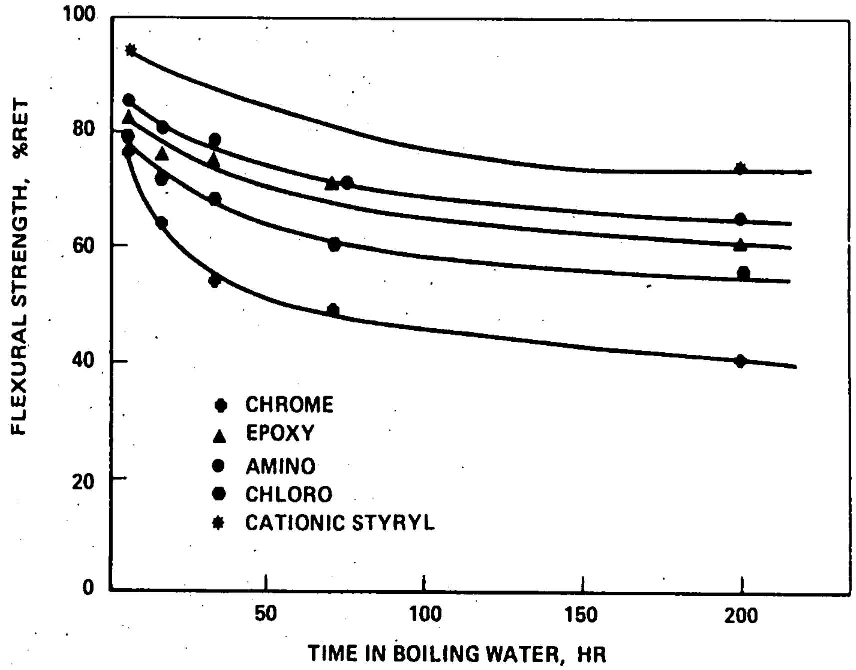


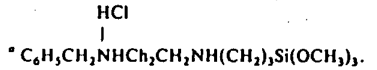
Figure 6.3. Histograms showing the retention of flexural strength of epoxy-glass laminates after immersion in boiling water.

It is somewhat unexpected that a styrene-functional silane and a methacrylate-functional chrome complex are effective coupling agents with dicyanamide cured epoxies (G-10). Reactive double bonds must participate in the epoxy cure reactions. In fact, epoxies are fairly good initiator for double-bond polymerization.[12] The vinylbenzyl cationic silane (H) is among the best coupling agents in G-10 epoxies. A comparable benzyl cationic silane was also a good coupling agent, but not as good as the vinylbenzyl silane H. The vinyl group of H seems to offer additional advantage in the coupling reaction (Table 6.12).

In addition to standard laminate evaluations as shown in Table 6.12 and Figure 6.3, a "pressure cooker" test is valuable in predicting whether completed circuit boards will withstand humidity cycling. Penetration of water into the interfacial region can be accelerated by boiling the coupons in a pressure cooker, and observed by immersing the boiled coupons into

Table 6.12. Properties of G-10 Epoxy Laminates
(18 plies of style 7628 fabric)

Property	Property of laminate		
Silane on glass	Silane H	Benzyl silane[a]	Epoxy silane C
Resin content, %	37.1	37.7	39.6
Water absorption @ 23°, %	0.062	0.068	0.039
Barcol hardness	65	62	60
Flexural strength, MPa			
A (dry)	577	541	520
D (2-hr water boil)	505	469	453
Compressive strength, MPA			
A	341	372	377
D	332	332	338
Tensile strength, MPa			
A	430	374	363
D	348	325	334
Dielectric constant @ 1 Mc/s			
A	4.80	4.85	4.74
D	4.88	4.92	4.83
Dissipation factor @ 1 Mc/s			
A	0.018	0.018	0.019
D	0.019	0.019	0.021

[a] 
$C_6H_5CH_2NHCh_2CH_2NH(CH_2)_3Si(OCH_3)_3 \cdot HCl$.

molten solder. Sudden conversion of water in the interior of the laminate to steam causes delamination, which may be observed visually. There is no standard "pressure cooker test," although many laboratories use some modification of this technique to separate "good" laminated from "bad" laminates.

6.5. Phenolic Resins

Silane coupling agents may be used to improve the properties of virtually all mineral composites with phenolic resins. Aminofunctional silanes are used with phenolic resin binders on fiberglass insolution, on fiberglass tire cord with resorcinol-formaldehyde resin in RFL dip, and with furan or phenolic resins as binders for sand cores used in metal castings. Aminosilanes have also been proposed with phenolic resins in sand consolidation of oil wells.[13]

Silane coupling agents are commonly used to treat alumina and silicon carbide granules to increase resin wet-out and the mechanical strength of bonded abrasive wheels. Mineral-filled phenolic molding compounds are other obvious areas for improvement through silanes.

The use of silanes as integral blends in phenolic sand core binders illustrates a problem found in a number of silane-resin systems. The silane additives may be reactive with the resin at room temperature, but after storage for even a few hours the silanes lose coupling activity. To be effective, the silanes must be monomeric so they can migrate quickly to filler or reinforcement before the system cures. Premature reaction with the resin reduces mobility such that trace amounts of silane additive becomes ineffective in adhesion promotion. Furane resins, urethanes, and sometimes epoxies resemble phenolic resins in this behaviour. Pretreatment of the filler gives complete utilization of silane adhesion promoters, but is much more costly than simple addition of silane as an integral blend.

"Dog biscuit" test pieces of sand cores were made by mixing 2 parts of catalyzed resin with 98 parts of sand and loading them into steel molds preheated to 232°C. Materials tested were a phenolic, and a furan resin supplied by Core-Lube®. Initial tensile strengths of the test pieces were all in the range of 25-30 MPa, but after exposure to 100% relative humidity at 38°C for 24 hr, strengths dropped to 2-3 MPa, unless an effective adhesion promoter was present. Performance of the diamine-functional silane (F) as adhesion promoter is shown by the wet strength of test pieces with 0.5% silane added to the resin system (Table 6.13). By adding the silane to the catalyst, stable two-part resin systems were obtained. The silane could also be added as a third component at the time of mixing, but this would be very inconvenient in field applications.

Table 6.13. Wet[a] Tensile Strengths (MPa) of Sand Core Test Pieces

0.5% Silane (F) additive	Wet tensile strength, MPa	
Conditions	Furan resin	Phenolic resin
No silane, control	2.7	2.4
In resin, immediate	17.8	8.6
In resin, 2 hr old	13.5	8.8
In resin, 9 days old	9.7	3.2
In catalyst, 46 days old	17.9	9.2
On sand (none in resin)	21.1	9.4

[a] After 24 hr at 38°C and 100% relative humidity.

6.6. High-Temperature Resins

Cross-linked thermosetting resins are infusible after curing and tend to retain useful mechanical properties up to temperatures approaching their thermal breakdown temperatures.

Aliphatic silane coupling agents have heat stabilities comparable to those of conventional thermosetting polyesters, epoxies, and phenolics, but lack oxidation resistance at temperatures wihin the operation range of polymides and other high-temperature resins.[14] Flexural-strength measurements on an early fiberglass-reinforced polyimide composite illustrate the loss in coupling performance at high temperatures. Fiberglass cloth was treated with an aminofunctional silane (E) and laminated with Skybond® 709 resin (Monsanto Chemical Company). Dry and wet (2-hr water boil) flexural strengths were measured on the finished laminate and after heat-aging for 100 hr at 250°C and 318°C (Table 6.14). There was little deterioration of the resin in 100 hr at 318°C as indicated by good dry-strength retention, but the silane at the interface must have decomposed, as indicated by loss in wet strength. Exposure of similar laminates for 100 hr at 318°C in an atmosphere of nitrogen caused little deterioration of either dry or wet strength.

Aromatic organofunctional silanes[14] have a useful temperature range at least 100° higher than that of aliphatic silanes, but none is available commercially. Presence of an aromatic group in the silane molecule seems to impart some improved high-temperature resistance, even though the ultimate bond to silicon is through an aliphatic link. Silane H with a vinylbenzyl group was compared with silane E on glass fabric in polyimide (Resin PN-13, Ciba Geigy) laminates. Silane H contributed better initial properties and better retention of properties after 100 hr at 285°C in air[15] (Table 6.15).

Although aminophenyl silane coupling agents show relatively poor heat stability, it has been reported that when this compound is converted

Table 6.14. Flexural Strength Retention of a Polyimide Laminate (aminosilane (E) on glass)

Heat treatment	Flexural strength (% of initial)	
	Dry	2-hr boil
As laminated	100	94
After 100 hr at 260°C in air	104	91
After 100 hr at 318°C in air	99	25

Table 6.15. Polyimide[a] Laminates with Silane-Treated Style 7628 Glass Cloth (0.5% silane finish on glass)

Property	Silane H		Silane E	
	Dry	Wet	Dry	Wet
Flexural strength, MPa				
Initial	508	492	420	366
After 100 hr at 285°C	—	415	—	282
Dielectric constant @ 1 Mc/s	4.56	4.80	4.80	4.95
Dissipation factor @ 1 Mc/s	0.006	0.007	0.020	0.021
Dielectric breakdown, KV	>70	>70	45	40

[a] Data of Vaughan.[16]

Table 6.16. Thermal Stability of CA-25 and Silane E with Polyimide Coating on Silcon

Heat treatment time at 400°C (hr)	Peel strengths retained (%)			
	Air atmosphere		Nitrogen atmosphere	
	CA-25	Silane-E	CA-25	Silane E
0	100	100	100	100
1	62	38	99	88
2	52	28	95	—
2.5	—	—	—	81
3	50	—	97	—
4	41	—	99	75

Table 6.17. S-Glass Laminates with Kerimid 601® Polimide

Properties of laminates	Mixed silanes M		Silane E	
	MPa	psi	MPa	psi
Flexural strength initial	544	78,900	476	69,000
1000 hr at 260°C	409	59,400	258	37,400
2000 hr at 260°C	306	44,400	134	29,400
Flexural modulus, initial	24×10^3	3.5×10^6	23×10^3	3.4×10^6
1000 hr at 260°C	21×10^3	3.0×10^6	22×10^3	3.2×10^6
2000 hr at 260°C	20×10^3	2.9×10^6	18×10^3	2.5×10^6

Table 6.18. Properties of S-Glass Laminates with PEEK Resin
(45 volume percent glass)

Coupling agent on glass	Flexural strength		Interlam-shear strength	
	MPa	psi	MPa	psi
None	365	52.900	27	3.930
Aminosilane F	553	80.240	35	5.070
Mixed silanes M	669	97.000	37	5.360

into an oligomeric polyamide that the product designated CA-25 showed good coupling of polyamide films to silicon wafers[16] with greatly improved thermal stability over that obtained with silane E coupling agent (Table 6.16).

Mixed silanes, containing a high proportion of phenyl trimethoxysilane provide siloxane films with thermal stability comparable to phenylsilicone with adequate chemical reactivity to bond to polymers.[17] Preliminary tests in polyamide (Table 6.17) and PEEK (Table 6.18) laminates show mixture M to be far superior to aminofunctional silanes E or F.

6.7. Other Polymers

Silane coupling agents were screened as adhesion promoters for thermoplastic polymers by fusing the resins under light pressure to primed microscope slides or metal coupons and rating them according to the retention of adhesion after soaking in water (cf. Section 6.4.2 for rating system).[17] One series of rigid thermoplastics was fused to glass at 200°C to 300°C (Table 6.19). Another series of thermoplastic polymers was fused at 225°C to 400°C to aluminum (Table 6.20). More flexible thermoplastics were used to glass at moderate temperatures and rated similarly (Table 6.21). Most of the thermoplastics may be considered to be nonreactive with silanes at fusion temperatures. The mechanism of adhesion, therefore, must be some form of interdiffusion and cross-linking of the primer to form pseudointerpolymer networks at the interface.

The adhesion of rubber to silane primers on glass microscope slides was correlated with the performance of the same silanes on particulate fillers as reinforcements in the rubbers. Peel strengths of elastomers vulcanized against primed microscope slides are shown in Table 6.22. Silane H was the most universal adhesion promoter primer of commercially available silanes.

Table 6.19. Adhesion of Rigid Thermoplastics to Glass

Primer	Rigid PVC 200°C	HDPP Herc.-6323 250°C	Polystyrene Styron-430 250°C	ABS Dow 275°C	Nylon Zytel 275°C	PPS Ryton 300°C
F	+	–	–	+	+	+
D	–	–	–	–	+	–
H	+	++	++	++	++	–
C	–	–	–	–	+	–
G	–	–	–	–	+	–
B	+	+	–	–	+	–
E	–	–	–	–	+	–
A	–	–	–	–	–	–
M	+	–	–	–	++	++
N	+	–	–	–	++	+++

Table 6.20. Adhesion of Rigid Thermoplastics to Aluminum

Primer	Polyformal Delrin 225°C	PBT Valox-310 275°C	Polycarbonate Lexan 275°C	PEEK film 400°C	Polysulfone 30-100 300°C
F	–	–	+	–	+
D	–	–	+	–	–
H	++	+	+	+	+
C	–	++	+	–	+
G	+	–	–	–	+
C	–	–	+	–	–
E	–	–	+	–	+
A	–	–	–	–	–
M	–	–	++	+	–
N	–	++	++	++	++

6.8. Coatings

The same silanes that are recommended in fiberglass-reinforced epoxy composites are effective primers on metals with comparable polymer coatings. A simple silane primer on metal may give performance comparable to more expensive etchings and chemical modification that provides a porous surface on the metal for mechanical interlocking of the polymer.

Very little has been published on specific applications of silanes in commercial coatings. Primer suppliers and coatings manufacturers consider their formulations proprietary and do not disclose use of silanes in the formulations.

Table 6.21. Adhesion of Flexible Thermoplastics to Glass

Primer	PVC plastisol 180°C	EVA CXA-2022 150°C	SBR block Kraton-1102 200°C	Hi M.W. HDPE 240°C	Mod-PE Plexar-6 240°C	Urethane Estane-3702 175°C	Polyester Hytrel-5525 275°C
F	+	−	+	−	+	−	−
D	−	++	+	+	−	−	−
H	++	−	++	++	++	++	+
C	−	−	−	−	++	++	+
G	−	+	++	−	+	++	−
B	−	+	+	+	+	+	++
E	+	−	−	−	+	−	−
A	−	+	−	+	−	−	−
M	++	−	+++	−	+	++	−
N	+	++	−	−	−	+++	++

Table 6.22. Adhesion of Vulcanizing Elastomers to Glass (glass treated with 1% aqueous silane)

Silane treatment on glass	Peel strength of elastomer to glass (N/cm)						
	EPDM						
	Peroxide	Sulfur	SBR	Natural	Nitrile	Neoprene	Hypalon
None	Nil	Nil	Nil	0.2	Nil	Nil	2.1
F	2.3	6.1	2.1	7.7	14.0	1.9	c
D	5.1	8.1	0.2	0.9	0.2	0.2	3.5
H	c	c	3.5	8.4	9.6	3.9	c
G	2.6	14.9	5.3	3.5	2.1	7.0	4.6
B	0.2	2.0	0.2	1.1	0.9	0.2	2.1
E	3.7	10.0	1.9	2.5	0.2	0.2	10.5
A	2.0	3.9	1.6	1.2	0.2	0.2	3.2

c = cohesive failure in polymer at >30 N/cm.

Walker[18] compared various silane adhesion promoters as primers and as additives in urethane and epoxy paints. A two-part epoxide-polyamide resin, and a two-part aliphatic isocyanate adduct-cured polyester paint were pigmented with rutile titanium dioxide. Adhesion of the coatings to aluminum and steel was measured after soaking for 1500 hr in water at room temperature, and again after recovering for 48 hr at room temperature and humidity. Wet and recovered adhesion were measured by direct pull-off on mild steel on primed, degreased, or sand-blasted surfaces (Table 6.23). Silane primers on degreased steel were often superior to unprimed adhesion on sand-blasted steel. The diamine-functional silane (F) and the mercaptan-functional silane (G) were the preferred primers. Silane primers were also tested on cadmium, copper, and zinc. Several of the silanes promoted good adhesion through 1000 hr of accelerated weathering exposure to an enclosed carbon arc with water spray. It was rather surprising to observe that the methacrylate silane was fairly effective with both urethane and epoxy paints on several of the metals, although the diamine silane (F) gave most consistent improvement in adhesion when used as a primer.

Silanes were also compared as additives in the same paints on unprimed metals. Data of Table 6.24 (on aluminum) indicate that silanes are especially effective in improving recovery of adhesion after the water soak. These data are consistent with the "reversible hydrolytic bond theory" of adhesion (cf. Section 5.2.3).

Some of the most stringent requirements for adhesion of coatings are those for photoresists on oxidized silicon chips used in electronics. Improved

Table 6.23. Wet and Recovered Adhesion Values on Mild Steel

Paint	Silane/treatment (2% silane of Table 6.1)	Wet adhesion, MPa/% detached	Recovered adhesion, MPa/% detached
Polyurethane	Degreased only	5.6/100	6.8/100
	G/Degreased	5.4/100	12.1/100
	F/Degreased	7.4/90	12.5/90
	Sandblasted only	11.8/95	20.8/60
	G/Sandblasted	23.6/10	29.1/0
	F/Sandblasted	22.7/30	29.1/0
Epoxide	Degreased only	7.2/100	10.9/100
	L/Degreased	17.3/100	21.8/90
	C/Degreased	14.3/100	15.6/100
	G/Degreased	10.9/30	15.4/100
	F/Degreased	28.1/0	29.2/10
	Sandblasted only	9.2/100	20.9/100
	L/Sandblasted	16.3/30	31.7/60
	C/Sandblasted	8.3/70	26.9/100
	G/Sandblasted	17.2/10	30.0/45
	F/Sandblasted	26.3/50	27.8/40

adhesion of photoresists to silicon was obtained with standard silane coupling agents to prevent undercutting during wet etching, and lifting of the coating during wet development of resists.[19] Even hexamethyldisilazane, which is usually considered a hydrophobing agent, was effective in preventing undercutting during etching. Each silane adhesion promoter must be matched with a proper spinning solvent (zero contact angle), proper preparation of the chip, and match the individual photoresist employed.

Table 6.24. Wet and Recovered Adhesion Values on Aluminum

Paint	% Silane/treatment (Table 6.1)	Wet adhesion, MPa/% detached	Recovered adhesion, MPa/% detached
Polyurethane	Degreased only	1.3/100	Peeled while drying
	0.4% G/Degreased	11.7/100	13.8/30
	0.2% F/Degreased	9.5/100	14.5/100
	Sandblasted only	10.4/70	15.2/40
	0.1% F/Sandblasted	15.6/70	25.2/30
Epoxy	Degreased only	2.2/100	12.9/100
	0.2% G/Degreased	26.3/0	27.3/20
	0.2% F/Degreased	25.3/0	26.9/0
	Sandblasted only	7.4/100	22.2/20
	0.2% G/Sandblasted	25.1/0	26.7/5
	0.2% F/Sandblasted	28.2/0	28.7/0

6.9. Specific Primers

Adhesion of organic polymers to mineral surfaces is often obtained by first depositing an intermediate boundary layer as a primer. Silane-modified primers have been developed to promote adhesion of virtually any organic thermoplastic or thermosetting polymer to metals, glass, and other mineral surfaces, Formulations of commercial primers are proprietary, but certain generalizations can be made as guidelines in preparing silane-modified primers for any application[20]:

1. The primer must form a strong boundary layer, either by self-reaction or by reaction with the topcoating.
2. The final boundary layer must be either tacky (visco-elastic) or rigid with sufficient toughness and strength to carry the mechanical load imposed on the composite.
3. The boundary layer must have polar functional groups (preferably on silicon) for bonding to the mineral.
4. The primer film must have partial compatibility with the matrix polymer. This involves initial solution compatibility with the matrix resin during fabrication and may involve chemical reaction with the resin.
5. The primer film must resist complete solution in the topcoat, that is, it must contribute to a boundary layer at the interface. Resistance to solution is especially important with topcoatings applied from organic solvents or with topcoatings that contain large proportions of liquid monomers. A simple method of observing such solution "lifting" of a primer is to incorporate an intense dye in the primer. The dye should not float to the surface of the topcoat during fabrication of the composite.
6. The primer boundary layer must survive any environment (e.g., oxidation or high-temperature degradation) that the topcoat is expected to withstand. Ultraviolet weather resistance may not be required in the primer if used with pigmented topcoats.

In developing primer formulations, it is helpful to first observe film characteristics of the proposed primer. The cutting action of a razor blade on films deposited on microscope slides is very informative. Some monomeric silanes and aqueous solutions of some silanes give films on glass that dry in air to brittle powders that are relatively useless as primers. Initial films should be soft and develop toughness as they are cured. Sometimes coreaction with a topcoat is depended on for developing of cure. The films should be observed during various baking schedules. Films that remain soft and flexible will not develop a water-resistant bond to the mineral. Very hard films may have good adhesion to the substrate, but are so impervious that topcoats cannot develop a bond to them.

Some typical silane primers are described below with proposed applications.

6.9.1. Partially Prehydrolyzed Silanes in a Solvent[21]

50 parts silane D, E, F, or H
50 parts methanol
5 parts water

The mixture should be allowed to stand for a few hours at room temperature to equilibrate the oligomeric siloxane structures. The product is then stable indefinitely and may be used directly as a primer or diluted with more alcohol to optimum solids content. Partial prehydrolysis is especially effective with mixed silanes such as M of Table 6.1. Mixtures of silane F with A or $CH_3Si(OMe)_3$ form mixed oligomers that form stable solutions in water. Films of these primers are softer and tougher than those deposited from monomeric silanes or aqueous solutions of the same silanes. These primers are recommended for epoxies, phenolics, polyurethanes, melaminealkyds, polyvinylchloride solutions and plastisols, and numerous thermoplastics (especially with silane H). Primers based on silane H may benefit from addition of 0.5 to 1.0 parts of dicumyl peroxide.

6.9.2. Catalyzed Neutral Silanes

99 parts silane A, B, C, D, G, or L
1 part benzyldiamethylamine or silane F

The undiluted mixture may be used as integral additive in resin systems, or it may be diluted with about 900 parts of methanol to use as a primer. A prehydrolyzed primer may be prepared by adding 10 parts of water and 1 part of acetic acid to 1000 parts of the alcoholic primer solution. The primer is stable in acid solution, but when it is exposed in a thin film the acetic acid volatilizes with initial solvent loss, leaving an amine-catalyzed silanol for reaction with mineral surfaces.

6.9.3. Peroxide-Activated Primers

98 parts silane A, D, or H
2 parts dicumyl peroxide

The primer may be diluted with alcohols and then partially prehydrolyzed by adding water as in the examples of Sections 6.9.1 and 6.9.2.

6.9.4. Silane-Modified Epoxy[22]

The diamine-functional silane F is diffunctional in reaction with excess epoxy resins in alcoholic solvent. With loss of solvent from primer films, the third aminofunctional position becomes active, causing the primer to cross-link. This provides a one-component epoxy primer formulation with shelf stability of 6 months or more. Such primer films form very water-resistant bonds to metals and ceramic and engineering plastics, and are good primers for epoxies, phenolics, engineering thermoplastics, and urethanes. A typical formulation for an active primer for polyurethanes is:

8.4 parts liquid diglycidyl ether resin, e.g., DER 330® (Dow Chemical Co.)
1.6 parts silane F
90 parts propylene glycol monoethyl ether

6.9.5. Silane-modified Melamine Resins

Cold blends of silanes C or G with commercial melamine (or benzoguanamine) resins are very effective primers for epoxies, urethanes, or engineering thermoplastics.[23] These primers are believed to have initial solution compatibility with matrix resins but cross-link (possibly with some correaction with matrix resin) during fabrication of the composite to form an interpenetrating polymer network at the interface. Different degrees of reactivity and solubility may be formulated into a primer by selecting the proper commercial melamine resin.[24]

Melamine may react with up to 6 mol of formaldehyde to form methylol melamines. The methylol groups may condense with loss of water to form oligomers, or the methylol groups may be stabilized by etherification with low-molecular-weight alcohols. Taking into account these variations, melamine resins may be divided into four groups.

The resins in Group I are characterized by high free hydroxyl and a low degree of methylation. High molecular weight is possible. These resins are supplied in water and, consequently, have not been used in solvent-based primers.

Group II resins have relatively the same amount of free hydroxyl as the resins in Group I have. However, they have a higher degree of methylation and, consequently, lower molecular weight. These melamines are soluble in water or active solvents. Usually they are commercially supplied in an active solvent.

Group III resins have a relatively low amount of free hydroxyl and a high degree of methylation. They are basically monomeric, and they require cosolvent to be reducible in water.

The resins in Group IV are basically low-molecular-weight specialty melamines that have alcohols other than methanol reacted into them. They require strong cosolvent to achieve dispersibility in water.

In general, more stable primers are prepared with hexamethoxy-methyl melamine, (Cymel® 303, American Cyanamide), while more reactive primers result from mixtures of silanes with melamine resins like Resimene® 740 (Monsanto), or Cymel® 325 (American Cyanamide). A typical formulation that is effective as primer, or additive for urethanes, and as primer for engineering thermoplastics is:

90 parts Cymel® 303
10 parts silane C
300 parts methanol

When used as an additive to urethane resin systems, the methanol is omitted. This primer is also effective as an adhesion promoter for fluoro polymers such as Teflon® (DuPont).

6.9.6. Silane Tackifiers[25]

Cold blends of commercial tackifying resins and silane F in suitable solvents are effective primers for adhesion of thermoplastic elastomers. The same silane, and sometimes other alkoxysilanes, are effective as adhesion-promoting additives in hot-melt adhesive formulations.[26] Various ratios of silane F to resin may be used, although 2 phr is a good initial concentration for testing:

100 parts tackifying resin (e.g., Piccotex® 75, Hercules)
2 parts silane F
300 parts toluene

Applications of the above primers in various composite structures have been described.[3]

6.9.6.1. Applications in Polymer to Polymer Adhesion. Because many of the above primers are believed to function by interdiffusion in polymers with subsequent cross-linking to interpenetrating polymer networks (IPNs), it is not surprising to observe that a primer that will bond two different polymers to glass will bond the polymers to each other.[27]

6.9.6.2. Bonding TPR to Organic Surfaces. Because a given silane-modified tackifier may be a good primer for various dissimilar thermoplastic rubbers to mineral surfaces, it was expected that the same primer might improve adhesion of the rubbers to each other. Ethylene-vinylacetate copolymers (Elvax) were fusion-bonded to styrene-butadiene-block copolymers (Kraton) as described in Table 6.25. Under optimum conditions, a silane-tackifier primer (No. 6) gave such a strong bond that failure was entirely cohesive within one of the polymers.

6.9.6.3. Bonding Polyethylene to Polyester (Mylar) with a Hot-Melt Adhesive. Two dissimilar polymers can be bonded through an elastomeric adhesive if the polymer surfaces are primed separately with appropriate primers. Polyethylene sheets were primed with primer 3-H, while the polyester was primed with primer 5. The primed sheets were bonded at 150°C with hot-melt adhesives comprising simple elastomeric thermoplastics. No elastomeric thermoplastic was found that would give good adhesion to both unprimed surfaces. Observed peel strengths of typical elastomeric thermoplastics to both unprimed and primed polyethylene and polyester (Mylar®) are summarized in Table 6.26. Primers 3-H and 5 were effective on polyethylene and Mylar® with all the elastomers, but were of no value when reversed, that is, on Mylar® and polyethylene, respectively.

6.9.6.4. Bonding to Silicones. It is difficult generally to bond organic polymers to vulcanized silicone elastomers. Primer F-1 (based on partially prehydrolyzed silane F), and primer F-6 (2% silane F in Piccotex®-75

Table 6.25. Elvax® 40[a] Bonded at 150° to Kraton® 1102[b]

	Static peel strength, N/cm	
Primer 6 applied to Kraton® 1102	Initial	Wet 4 days
No primer	26.6	16.1
Resin alone	48.4	18.5
10% silane F in resin	77.0[c]	46.2

[a] Elvax® = E/VA copolymer product of DuPont.
[b] Kraton® = SBS block copolymer of Shell.
[c] Cohesive failure in Elvax®.

Table 6.26. Bonding Polyethylene to Mylar® through "Hot Melts" at 150°C.

"Hot melt" polymer	Primer on polyethylene	Peel strength to polyethylene, N/cm	Primer on Mylar®	Peel strength to Mylar®, N/cm
CXA 1104[a]	None	49	None	0.7
CXA 1104[a]	3-H	[c]	5	[c]
CXA 1025[a]	None	1.8	None	0.8
CXA 1025[a]	3-H	[c]	5	[c]
CXA 2022[a]	None	12.2	None	Nil
CXA 2022[a]	3-H	[c]	5	[c]
Vitel 5571[b]	None	3.5	None	11.5
Vitel 5571[b]	3-H	[c]	5	[c]
Vitel 5571[b] (reverse prime)	5	5.0	3-H	9.6

[a] Product of DuPont.
[b] Product of Goodyear.
[c] Cohesive failure in adhesive at >50 N/cm.

tackifying resin) are fairly good primers on some room-temperature vulcanized (RTV) silicone elastomers, but for most silicones it is necessary to activate the surface by flame or plasma treatment. Contacting the silicone surface with a blue gas flame for about 1 sec is sufficient to activate it. Organic polymers such as urethanes, EVA copolymers, styrene-butadiene block copolymers, and others that bond to silane primers on glass will bond to silane primers on flame-treated silicone as shown in Table 6.27. Flame treatment, or primers alone, did not give good adhesion to silicones in these tests.

Table 6.27. Bonding to Cured Silicone Elastomers (N/cm peel).

Silicone	Primer on silicone	Elvax® 150 at 150°C		Kraton® 1102 at 210°C	
		Untreated	Flame treated	Untreated	Flame treated
DC 9596	None	0.6	0.6	0.2	1.0
DC 9596	F-1[a]	1.5	23.1	1.5	[c]
DC 9596	F-6[b]	0.8	10.4	0.3	[c]
DC 3140	None	0.2	0.5	0.3	—
DC 3140	F-1[a]	0.3	[c]	0.2	5.0
DC 3140	F-6[b]	0.4	13.5	0.3	9.6

[a] F-1 = partially prehydrolyzed silane.
[b] F-6 = 2% silane in Piccotex® 75.
[c] Cohesive failure in polymer at >30 N/cm.

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